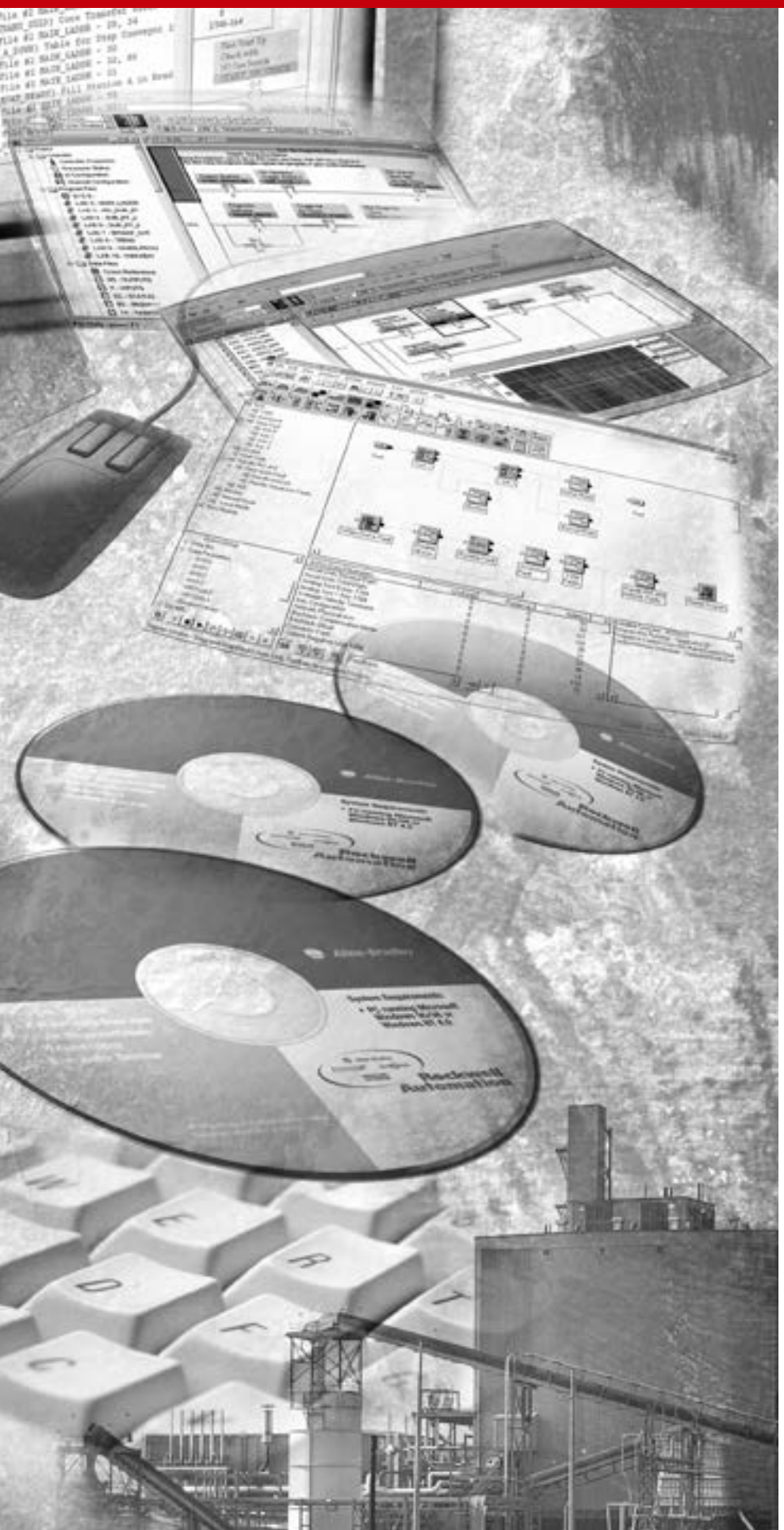


Allen-Bradley

Ultra5000 Series Intelligent Positioning Drives with DeviceNet

(Catalog Numbers 2098-IPD-005-DN, 2098-IPD-010-DN, and 2098-IPD-020-DN,

Reference Manual

Rockwell Automation

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley® does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI–1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION

Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss

Attention statements help you to:

- identify a hazard
- avoid a hazard
- recognize the consequences

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

Chapter 4

Programming Reference

Chapter 5

Troubleshooting DeviceNet Drives

Preface

Introduction

Read this preface to become familiar with the organization of the manual. In this preface, you will read about the following:

- Who Should Use this Manual
- Purpose of this Manual
- Contents of this Manual
- Related Documentation
- Conventions Used in this Manual
- Allen-Bradley Support

Who Should Use this Manual

This manual is intended for qualified service personnel responsible for setting up and servicing the Ultra5000™ drive with DeviceNet™. You must have previous experience with and a basic understanding of electrical terminology, programming procedures, networking, required equipment and software, and safety precautions.

Purpose of this Manual

This manual is a reference guide for using DeviceNet to configure, monitor, or control Ultra5000 drives with DeviceNet.

Contents of this Manual

This manual contains the following sections:

Chapter	Title	Contents
	Preface	An overview of this manual and Allen-Bradley technical support.
1	*The DeviceNet Interface*	Describes how to install, connect and commission an Ultra5000 with DeviceNet.
2	*DeviceNet Driver Installation*	Describes loading of the drivers and setup files for the Ultra5000 Drive with DeviceNet.
3	*DeviceNet Overview*	Introduces DeviceNet parameters and messaging
4	*Programming Reference*	Configuration data and behaviors implemented in the Ultra5000 Drive with DeviceNet are defined using object modeling.
5	*Troubleshooting DeviceNet Drives*	Describes troubleshooting actions for DeviceNet interfaces to Ultra5000 drives.

Related Documentation

These publications provide additional information specific to the Ultra5000 Drive with DeviceNet or DeviceNet in general. To obtain a copy, contact your local Rockwell Automation office or distributor.

For information about:	Read this document:	Publication Number
A glossary of industrial automation terms and abbreviations	*Allen-Bradley Industrial Automation Glossary*	AG-7.1
How to commission a DeviceNet system.	*DeviceNet Cable System Planning and Installation Manual*	DN-6.7.2
An overview of Allen-Bradley motion controls and systems	*Motion Control Selection Guide*	GMC-SG001*x*-EN-P
How to use RSNetWorx™	*RSNetWorx for DeviceNet Getting Results Manual*	9399-DNETGR
A description of the Ultra3000™ and Ultra5000 drives	*Ultra Family Brochure*	2098-BR001*x*-EN-P

For information about:	Read this document:	Publication Number
How to install and troubleshoot the Ultra5000 drive	*Ultra5000 Intelligent Positioning Drive Installation Manual*	2098-IN001*x*-EN-P
How to install Ultraware™	*Ultraware CD Installation Instructions*	2098-IN002*x*-EN-P
Configuring the Ultra3000 DSD and Ultra5000 IPD using Ultraware	*Ultraware User Manual*	2098-UM001*x*-EN-P

A copy of the DeviceNet Specification, Volumes I and II, Release 2.0 may be ordered from the web site http://www.odva.org of the Open Device Vendor Association.

Conventions Used in this Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps
- Numbered lists provide sequential steps or hierarchical information
- Words you type or select appear in bold.
- When we refer you to another location, the section or chapter name appears in italics
- Software commands and parameters are listed with initial capitals and hardware signals are listed in all capitals (e.g., Jog Program Velocity parameter, and ENABLE signal).

Allen-Bradley Support

Allen-Bradley offers support services worldwide, with over 75 sales/support offices, 512 authorized distributors and 260 authorized systems integrators located throughout the United States alone, plus Allen-Bradley representatives in every major country in the world.

Local Product Support

Contact your local Allen-Bradley representative for:

- Sales and order support
- Product technical training
- Warranty support
- Support service agreements

Technical Product Assistance

If you need to contact Allen-Bradley for technical assistance, please review the information in this manual or that listed in *Related Documentation* on page P-2 first. Then call your local Allen-Bradley representative. For the quickest possible response, we recommend that you have the catalog numbers of your products available when you call.

The DeviceNet Interface

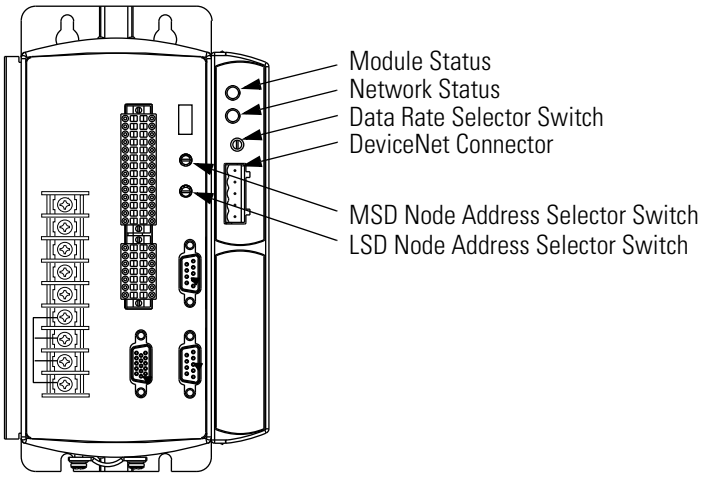
Installing, Connecting, & Commissioning Your Ultra5000 with DeviceNet

This manual serves as a reference for configuring, monitoring, and controlling an Ultra5000 drive through a DeviceNet interface. The following information is contained in this chapter.

- Wiring the DeviceNet connector.
- Setting drive addresses through the rotary switches.
- Configuring the data (baud) rate.
- Understanding the DeviceNet LED indicators.

Refer to the *Ultra5000 Intelligent Positioning Drive Installation Manual* (2098-IN001*x*-EN-P) for additional information regarding installation and troubleshooting of the main drive unit.

Figure 1.1
Ultra5000 DeviceNet External Connections



DeviceNet Connector Pins and Signals (P2)

Pin	Description	Signal
1	Network Power Common 24V DC	V-
2	Network Communication Signal Line	Can_L
3	Shield	Shield
4	Network Communication Signal Line	Can_H
5	Network Power 24V DC	V+

Planning Your DeviceNet Network

A DeviceNet network is a planned arrangement of electrical power and device distribution that is adjusted for optimal communications.

Before you add devices, record the following:

- Network data rate
- Network cable system map (topology) to which you are connecting
- Distances between cable system components
- Device current draw and voltage drop for each device on the network
- Limitation of the trunk and drop cables

Refer to the table below for recommended trunk and drop lengths.

Data Rates	125 Kbps		250 Kbps		500 Kbps	
	meters	feet	meters	feet	meters	feet
Thick Trunk Lines	500	1640	250	820	100	328
Thin Trunk Lines	100	328	100	328	100	328
Maximum Drop Length	6	20	6	20	6	20
Cumulative Drop Budget	156	5120	78	256	39	128

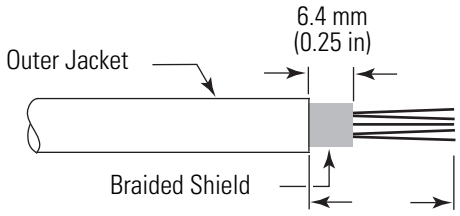
Refer to the *DeviceNet Cable System Planning and Installation Manual* (publication DN-6.7.2) for specific guidance in calculating and attaching the Ultra5000 to a network.

Connecting Your DeviceNet Cable

To attach a plugable, open style, screw-connector to the DeviceNet cable:

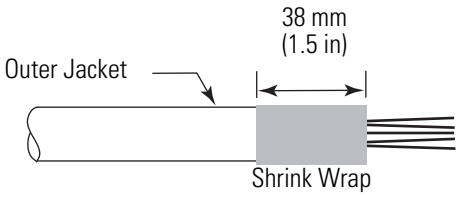
1. Strip 65 mm (2.6 in.) to 75 mm (2.96 in.) of the outer jacket from the end of the cable, leaving no more than 6.4mm (0.25 in.) of the braided shield exposed.

Figure 1.2
Exposing the braided shield



2. Wrap the end of the cable with 38 mm (1.5 in.) of shrink wrap, covering part of the exposed wires and part of the outer jacket.

Figure 1.3
Adding shrink wrap

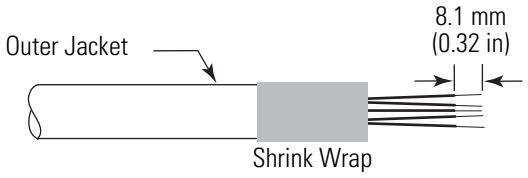


3. Strip 8.1 mm (0.32 in.) of the insulation from the end of each of the insulated wire.

   Note: Be careful not to nick, cut, or otherwise damage the individual strands of wire.

   Trim the last 6.5 mm (0.26 in.) of the bare wires so that the outside dimension does not exceed 0.17 mm (0.045 in.).

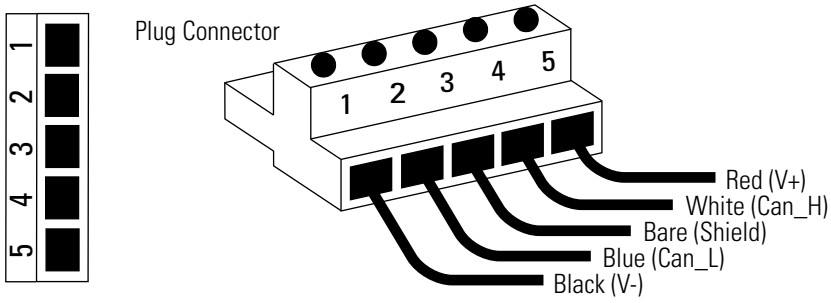
Figure 1.4
Exposing wire stands



4. Insert each wire into the appropriate clamping cavity of the plugable screw connector, according to the color of the cable insulation.

5. Use an 1/8 inch flat blade screwdriver to attach wires in the connector. Firmly tighten the clamping screws to secure each wire.

Figure 1.5
Wiring the DeviceNet connector



Terminal	Cable Color	Designation
1	Black	V -
2	Blue	Can_L
3	Bare	Shield
4	White	Can_H
5	Red	V +

6. Insert the connector on the Ultra5000 drive to attach the DeviceNet network.

Configuring Your Ultra5000 with DeviceNet

To configure your Ultra5000 drive with DeviceNet:

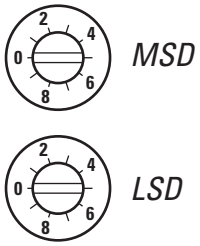
1. Verify that there is no power applied to the drive, and the DeviceNet cable is connected (refer to figures 1.1 through 1.5 in this chapter.

2. Set the node address for each drive in your system. Valid node addresses are 00-63 and PGM. The MSD rotary switch, Figure 1.6, sets the most significant digit and the LSD rotary switch sets the least significant digit. For switch locations, refer to Figure 1.1 on page 1-1 of this chapter. The following table provides examples.

For this Node Address:	Set the MSD switch to:	Set the LSD switch to:
10	1	0
11	1	1
12	1	2

Figure 1.6
MSD and LSD Rotary Switches

Use the MSD and LSD rotary switches on the DeviceNet panel of the drive to set node addresses.



Note: Selecting an invalid node address (> 63) sets the node address according to a non-volatile parameter stored in the drive.

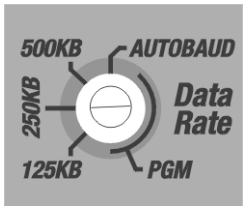
Refer to the *Ultra5000 Intelligent Positioning Drive Installation Manual* (2098-IN001x-EN-P) for a listing of reserved node addresses.

3. Set the data rate switch, Figure 1.7, to the established DeviceNet network data rate. Valid data rates are 125 kbps, 250 kbps, 500 kbps, AUTO, and PGM. Refer to Figure 1.1 on page 1-1 for the switch location on the drive.

Note: Selecting AUTO automatically matches the device data rate to the rate of the network. Selecting PGM sets the data rate according to a non-volatile parameter stored in the drive.

Figure 1.7
Data Rate Rotary Switch

Use the Data Rate rotary switch on the DeviceNet panel of the drive to set the data rate.



4. Apply power to the drive.

5. Observe the module status LED.

If the module status LED:	Then:
Is not steady green	Refer to *Troubleshooting DeviceNet Drives* on page 5-1.
Is steady green	The drive is ready. Go to step 6.

6. Observe the network status LED.

If the network status LED:	Then:
Is off	Establishing communication with network (wait for flashing or steady green).
Is not flashing or steady green	Refer to *Troubleshooting DeviceNet Drives* on page 5-1.
Is flashing or steady green	Communication is ready. Go to Chapter 2.

DeviceNet Driver Installation

Follow the procedure listed in the *Ultraware User Manual* (publication 2098-UM001x-EN-P) to load and create the requisite DeviceNet drivers for the Ultra5000 drive.

1. Install the following files as Drivers to the Ultra5000 drive:

   - DNetLoad.exe
   - DNetServ.exe

2. Load the following files to the Files branch of the Ultra5000 drive:

   - DNetBoot.hex
   - DNetMain.hex

3. Cycle power on the Ultra5000 and verify that within approximately 15 seconds the green Module Status LED on the DeviceNet interface is lit (on). This indicates successful installation of the drivers. The Module Status LED will flash red-green while the DeviceNet interface card is being initialized.

4. Select Rescan from the Tools menu. Verify the DNetServ.exe automatically creates the following Global Variables in the Workspace of the Ultra5000 drive.

Name	Type	Number of Elements
DNetConfigData	Long Int	8
DNetIntArray	Long Int	32
DNetFltArray	Float	32

IMPORTANT If the Ultra5000 Drive Properties are Reset to Factory Settings with Ultraware, the DeviceNet drivers are erased and must be reinstalled.

Configuring Ultra5000 DeviceNet Using the DNetConfigData Array

The DNetConfigData array is the interface for configuring DeviceNet on the Ultra5000. The array is a standard Ultra5000 long integer array and is automatically created by the DeviceNet driver program. For more information on arrays, see the Ultra5000 Programming Manual.

Array Index 0 – PGM MAC ID

The programmed non-volatile DeviceNet Node Address (MAC ID).

Value	Description
0 to 63	MAC ID range (default is 63)

Array Index 1 – PGM Baudrate

The programmed non-volatile DeviceNet Data Rate.

Value	Description
0	125 kps (default)
1	250 kps
2	500 kps
3	Autobaud

Array Index 2 – DeviceNet Module Fault Action

ATTENTION

Risk of severe bodily injury or equivalent damage exists.

The Module Fault Action value allows you to change the default configuration, and to potentially allow the drive to continue to operate when communication with the DeviceNet module is lost.

Determines the action the drive should take when it cannot communicate with the DeviceNet module.

Value	Description
0	DeviceNet fault E14 (default)
1	Ignore

Array Index 3 – DeviceNet Idle Fault Action

ATTENTION

Risk of severe bodily injury or equivalent damage exists.

The Idle Fault Action value allows you to change the default configuration, and to potentially allow the drive to continue to operate when communication with the DeviceNet module is lost.

Determines the action the drive should take if the master sends a zero length I/O message to the drive, which may occur if a PLC (master) is set to program mode. No action will be taken if I/O Receive Select is set to 0 (No data consumed).

Value	Description
0	DeviceNet fault E14 (default)
1	Ignore

Array Index 4 – DeviceNet Comm Fault Action

ATTENTION

Risk of severe bodily injury or equivalent damage exists.

The Comm Fault Action value allows you to change the default configuration, and to potentially allow the drive to continue to operate when communication with the DeviceNet module is lost.

Determines the action the drive should take if the drive detects a network failure while an I/O messaging connection is active.

Value	Description
0	DeviceNet fault E14 (default)
1	Ignore

Array Index 5 – I/O Transmit Select

Selects the input (produced) assembly that is transmitted by the drive over a Polled I/O Messaging Connection. If the value is modified, you have to either close any existing I/O Messaging connection(s), power cycle the drive, reset the drive, or remove and reapply DeviceNet power for the drive to use the modified value.

Refer to *Assembly Object, Instance ID = 1 - 16* on page 4-12 for information on the data format.

Value	Description
0	No data produced.
1	One Integer: DNetIntArray[0]
2	Two Integers: DNetIntArray[0], DNetIntArray[1]
3	One Float: DNetFltArray[0]
4	Two Floats: DNetFltArray[0], DNetFltArray[1]
5	One Integer, One Float: DNetIntArray[0], DNetFltArray[0]
6	Two Integers, One Float: DNetIntArray[0], DNetIntArray[1], DNetFltArray[0]
7	One Integer, Two Floats: DNetIntArray[0], DNetFltArray[0], DNetFltArray[1]
8	Two Integers, Two Floats: DNetIntArray[0], DNetIntArray[1], DNetFltArray[0], DNetFltArray[1]

Array Index 6 – I/O Receive Select

Selects the output (consumed) assembly that is updated when a Polled I/O Message is received by the drive. If the value is modified, you have to either close any existing I/O Messaging connection(s), power cycle the drive, reset the drive, or remove and reapply DeviceNet power for the drive to use the modified value.

Refer to *Assembly Object, Instance ID = 1 - 16* on page 4-12 for information on the data format.

Value	Description
0	No data consumed
1	One Integer: DNetIntArray[2]
2	Two Integers: DNetIntArray[2], DNetIntArray[3]
3	One Float: DNetFltArray[2]
4	Two Floats: DNetFltArray[2], DNetFltArray[3]
5	One Integer, One Float: DNetIntArray[2], DNetFltArray[2]
6	Two Integers, One Float: DNetIntArray[2], DNetIntArray[3], DNetFltArray[2]
7	One Integer, Two Floats: DNetIntArray[2], DNetFltArray[2], DNetFltArray[3]
8	Two Integers, Two Floats: DNetIntArray[2], DNetIntArray[3], DNetFltArray[2], DNetFltArray[3]

Array Index 7 – DeviceNet Modules Status

This is a read-only value that indicates the last modules fault status. This value defaults to zero on power up and reset.

Value	Description
0	No Fault (default)
1	DeviceNet Idle Fault
2	DeviceNet Comm Fault

Array Index 8 – DeviceNet Loader Version

This is a read-only value that indicates the current version of DNetLoad.exe. The version number is displayed without periods (e.g. version 1.2.0 will display as 120).

Array Index 9 – DeviceNet Server Version

This is a read-only value that indicates the current version of DNetServ.exe. The version number is displayed without periods (e.g. version 1.2.0 will display as 120).

DeviceNet Overview

Introduction

DeviceNet is an open, global industry-standard communication network. It is designed to provide an interface from a programmable controller through a single cable directly to smart devices such as sensors, push buttons, motor starters, simple operator interfaces and drives.

Features

The Ultra5000 Drive with DeviceNet Interface provides the following features:

- Ultra5000 Drive with DeviceNet implements the Unconnected Message Manager (UCMM) which is used to establish a Group 3 Explicit Message connection. Up to five Group 3 Explicit Messaging connections can be established.
- Faulted-node Recovery, allows the node address of a device to be changed even when it is faulted on the network. This feature requires the support of proper PC software tools and the Node Address (0-63, PGM) switches be set to the PGM (program) position.
- Software configuration lets you configure the Ultra5000 Drive with DeviceNet using RSNetWorx for DeviceNet (3.00.01 or later, version 3.00 with Service Pack 1).
- Autobaud allows the drive to determine the network data rate.

Note: User programs and files cannot be loaded to the Ultra5000 drive over DeviceNet.

Parameters and Electronic Data Sheet

The Ultra5000 with DeviceNet contains a set of parameters that are used to configure and monitor the drive. You can perform configuration by changing the values associated with individual parameters. Parameter values may be written and read via DeviceNet. Writing a value to a parameter may configure drive operations such as the acceleration or deceleration rates. Writing a value to a parameter may also configure DeviceNet operations such as which input and output assemblies are to be used for I/O communications with a master (scanner). The parameter set is documented in *Programming Reference* beginning on page 4-1.

Electronic Data Sheet (EDS) files are specially formatted ASCII files that provide all of the information necessary for a configuration tool such as RSNetworx for DeviceNet to access and alter the parameters of a device. Information about each parameter is contained in the file such as parameter min, max, and default values, parameter data format and scaling, and the parameter name and units. You can create or access an EDS file stored in the Ultra5000 Drive with DeviceNet via RSNetworx for DeviceNet (3.00.01 or later, version 3.00 with Service Pack 1) or download an EDS file for the Ultra5000 Drive with DeviceNet from Rockwell Automation/Allen-Bradley web-site www.ab.com/networks/eds.

DeviceNet Messaging

The Ultra5000 with DeviceNet operates as a slave device on a DeviceNet network. The drive supports Explicit Messages and Polled I/O Messages of the predefined master/slave connection set. The drive also supports the Unconnected Message Manager (UCMM) so that up to five Group 3 Explicit Message connections may be established with the drive.

Predefined Master/Slave Connection Set

A set of messaging connections that facilitate communications and is typically seen in a master/slave relationship is known as the Predefined Master/Slave Connection set. The master is the device that gathers and distributes I/O data for the process controller. A DeviceNet master scans its slave devices based on a scan list it contains. Each slave device returns I/O data to its master device. The I/O data exchanged over this connection is pre-defined.

Explicit Response/Request Messages

Explicit Request messages are used to perform operations such as reading and writing parameter values. Explicit Response messages indicate the results of the attempt to service an Explicit Request message.

Polled I/O Command/Response Messages

The Poll Command is an I/O message transmitted by the master device. A Poll Command is directed toward a specific slave device. A separate Poll Command must be sent to each slave device that is to be

polled. The Poll Response is the I/O message that the slave device transmits back to the master device.

I/O Messaging and Explicit Messaging with DeviceNet

You can configure and monitor the drive with either I/O Messaging or Explicit Messaging. I/O messages are for time-critical, control-oriented data. I/O messages typically are used for moving predefined data repeatedly with minimum protocol overhead. Explicit Messages provide multi-purpose, point-to-point communication paths between two devices. Explicit Messaging typically would not be used to exchange data periodically since I/O Messages have a higher priority and lower protocol overhead than Explicit Messages. However, Explicit Messages have more flexibility by specifying a service to be performed and a specific address.

Selecting Input and Output Assemblies for I/O Messages

The Ultra5000 with DeviceNet provides sixteen generic Input and Output Assemblies. The choice of which Input and/or Output Assembly to use should be based on the type of information that is appropriate in the particular system. The I/O Assemblies are mapped to the first four 32-bit values of the Long Integer (DNetIntArray) and Floating-point (DNetFltArray) arrays

The Ultra5000 has no pre-defined information stored in these locations. The contents of the locations are under user program control, and it is the responsibility of the user program(s) to update and utilize the values as necessary.

The choice of which Input and Output Assembly to use should be based on what sort of information is appropriate in a particular system. You should keep in mind that larger assemblies utilize more network bandwidth. Information on the data format of all the Assemblies is given in *Assembly Object (Class ID 04H)* on page 4-11.

Programming Reference

The Ultra5000 Drive with DeviceNet implements a vendor specific device profile - Rockwell Automation Miscellaneous (Device Type: 73hex).

The configuration data and behaviors implemented in the Ultra5000 Drive with DeviceNet are defined using object modeling. The Ultra5000 Drive with DeviceNet is modeled as a collection of objects. An Object is a collection of related attributes and services. An attribute is an externally visible characteristic or feature of an object, while a service is a procedure an object can perform.

The following general definitions also may be useful in understanding DeviceNet object modeling:

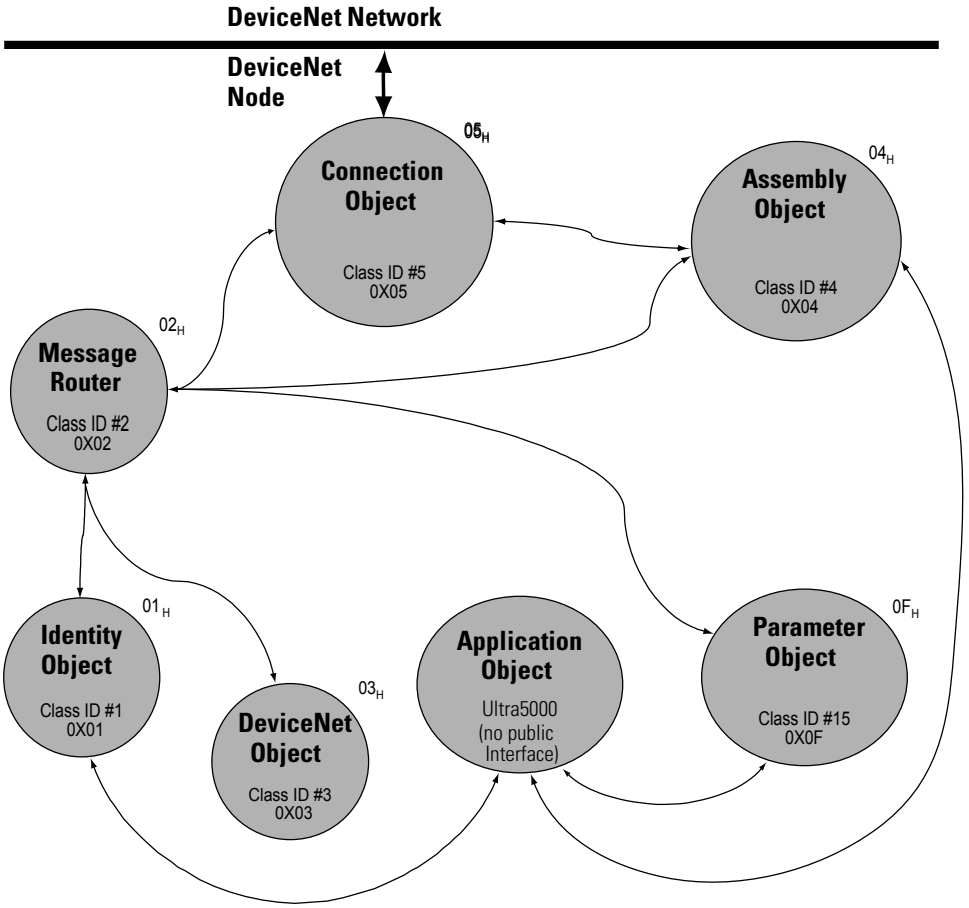
- Object - A representation of a particular type of data component within the DeviceNet node.
- Instance - A specific occurrence of an Object.
- Attribute - A description of a characteristic or feature of an Object. Attributes provide status information or govern the operation of an Object.
- Service - A function performed by an Object.

Object Model

The Object Model diagram on Page 4-2 depicts the objects supported in the Ultra5000 Drive with DeviceNet. The following table indicates the object classes present in this device, and the number of instances present in each class.

Object Class	Number of Instances
Identity	4
Message Router	1
DeviceNet	1
Assembly	16
Connection	1 - I/O 6 - Explicit
Parameter	340

Figure 4.1
Object Model



How Objects Affect Behavior

The objects in the Ultra5000 Drive with DeviceNet affect its behavior as shown in the table below.

Object	Effect on Behavior
Message Router	No effect
DeviceNet	Configures port attributes (node address, data rate, and BOI)
Assembly	Defines I/O data format
Connection	Contains the number of logical ports into or out of the device
Parameter	Provides a public interface to the device configuration data

The Defined Object Interface

The objects in the Ultra5000 Drive with DeviceNet have the interface listed in the following table.

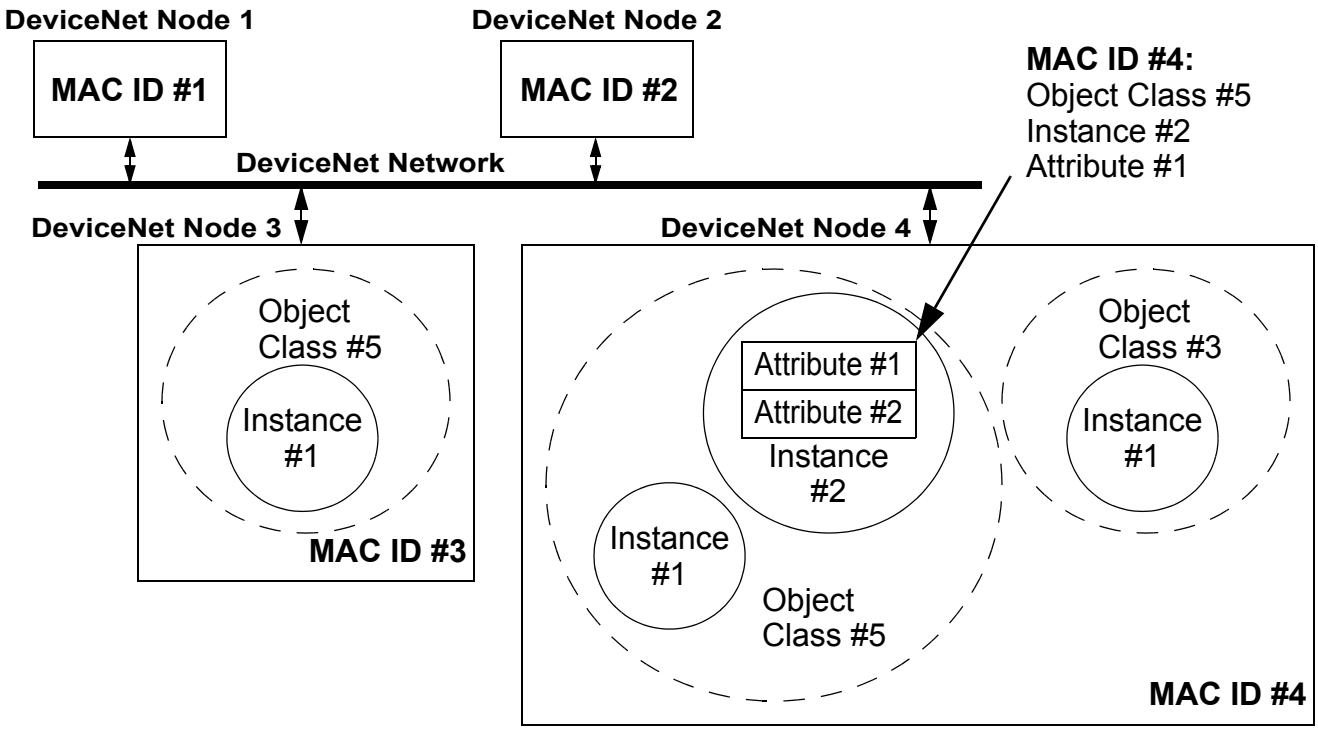
Object	Interface
Message Router	Explicit Messaging Connection Instance
DeviceNet	Message Router
Assembly	I/O Connection or Message Router
Connection	Message Router
Parameter	Message Router

Object Addressing

The Media Access Control Identifier (MAC ID) is the common basis for logically addressing separate physical components across DeviceNet. The MAC ID is a unique integer assigned to each DeviceNet node that distinguishes it specifically from among other nodes on the same network. The MAC ID often is referred to as the node address. Each component (object) is further identified with the following address components:

Component	Description
Class ID	The Class ID is a unique integer value assigned to each Object Class accessible from the network. The Ultra5000 supports an 8-bit Class ID.
Instance ID	The Instance ID is a unique identification assigned to an Object Instance that identifies it among all Instances of the same Class. It is also possible to address the Class itself by utilizing the Instance ID value zero (0). The Ultra5000 supports an 16-bit Instance ID.
Attribute ID	The Attribute ID is a unique identification assigned to a Class Attribute and/or Instance Attribute.

Figure 4.2
Node Objects



Data Type Definitions

The following mnemonics define the Ultra5000 with DeviceNet data types.

Mnemonic	Description
ARRAY	Sequence of Data
BOOL	Boolean (1 byte)
BYTE	Bit String (1 byte)
DINT	Signed Double Integer (4 bytes)
DWORD	Bit String (4 bytes)
EPATH	DeviceNet Path Segments
INT	Signed Integer (2 bytes)
REAL	Floating Point (4 bytes)
SHORT_STRING	Character String (1 byte length indicator, 1 byte per character)
SINT	Signed Short Integer (1 byte)
UDINT	Unsigned Double Integer (4 bytes)

Mnemonic	Description
UINT	Unsigned Integer (2 bytes)
USINT	Unsigned Short Integer (1 byte)
WORD	Bit String (2 bytes)

Identity Object (Class ID 01_H)

This object provides identification and general information about the device. The interface card implements four Identity Objects.

Identity Object, Attribute for Instance ID = 0 (Class Attributes)

Attr ID	Access Rule	Attribute Name	Type	Description	Semantics of Values
2	Get	Max Instance	UINT	Maximum instance number of an object currently created in this class level of the device.	The largest instance number of a created object at this class hierarchy level.

Identity Object, Instance ID = 1 - 4

Instance ID	Description
1	Adapter Main Firmware
2	Ultra5000 Main Firmware
3	Adapter Boot Firmware
4	Ultra5000 Boot Firmware

Identity Object,
Attributes of Instance ID 1

Attr. ID	Access Rule	Attribute Name	Data Type	Description	Semantics of Values
1	Get	Vendor ID	UINT	Identification of each vendor by number	01 = Rockwell Automation/ Allen-Bradley
2		Device Type		Indication of general type of product.	Instance 1: 115 = Rockwell Automation Miscellaneous Instances 2-4: 105 = Subcomponent
3		Product code		Identification of a particular product of an individual vendor	Instance 1: 64 = 2098-IPD-005-DN 65 = 2098-IPD-010-DN 66 = 2098-IPD-020-DN 102 = 2098-IPD-030-DN 103 = 2098-IPD-075-DN 104 = 2098-IPD-150-DN 105 = 2098-IPD-HV030-DN 106 = 2098-IPD-HV050-DN 107 = 2098-IPD-HV100-DN 108 = 2098-IPD-HV150-DN 109 = 2098-IPD-HV220-DN Instances 2-4: 01 = Firmware
4		Revision Major Minor	STRUCT of: USINT USINT	Revision of the item the Identity Object represents.	 Major Revision Minor Revision
5		Status	WORD	This attribute represents the current status of the entire device. Its value changes as the state of the device changes.	See table: *Identity Object, Status Description of Attribute ID 5*
6		Serial Number	UDINT	Serial number of device	Unique identifier for each device.
7		Product Name	SHORT_ STRING	Readable identification	Unique identifier for each product.

Identity Object,
Status Description of Attribute ID 5

Bit (s)	Description	Semantics of Values
0	Owned	TRUE = device has an owner
1		Reserved, set to 0
2	Configured	Always = 0

Identity Object,
Status Description of Attribute ID 5 (Continued)

Bit (s)	Description	Semantics of Values
3		Reserved, set to 0
4, 5, 6, 7		Vendor specific
8	Minor recoverable fault	Always = 0
9	Minor unrecoverable fault	Always = 0
10	Major recoverable fault	TRUE if self diagnosis detects a major fault
11	Major unrecoverable fault	Always = 0
12, 13		Reserved, set to 0
14, 15		

Identity Object,
Common Services

Service Code	Implemented for		Service Name	Service Description
	Class	Instance		
$0E_H$	Yes	Yes	Get_Attribute_Single	Returns the contents of the specified attribute.
05_H	No		Reset	Invokes the Reset service for the device.
11_H	Yes	n/a	Find_Next_Object_ Instance	Causes the specified class to search and return a list of instance IDs of existing instances of the Identity Object.

Reset Service

When the Identity Object receives a Reset request, it:

- determines if it can perform the reset
- responds to the request
- attempts to perform the reset

The Reset common service has the following object-specific parameter:

Identity Object, Reset Service			
Name	**Data Type**	**Description**	**Semantics of Values**
Type	USINT	Type of Reset	0 = Emulate as closely as possible cycling power of the drive. (default) 1 = Emulate cycling power as closely as possible. The drive can not be returned to out-of-box configuration without deletion of DeviceNet drivers and files.

Message Router Object (Class ID 02_H)

The Message Router Object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device.

Message Router Object, Attributes of Instance ID = 1					
Attr. ID	**Access Rule**	**Attribute Name**	**Data Type**	**Description**	**Semantics of Values**
2	Get	Number Available	UINT	Maximum number of connections supported	Count of the max number of connections supported
3		Number active		Number of connections currently used by system components	Current count of the number of connections allocated to system communication
4		Active connections	ARRAY of UINT	A list of the connection IDs of the currently active connections	Array of system connection IDs

Message Router Object, Common Services		
Service Code	**Service Name**	**Service Description**
$0E_H$	Get_Attribute_Single	Returns the contents of the specified attribute

DeviceNet Object (Class ID 03_H)

The DeviceNet Object provides configuration and status attributes of a DeviceNet port.

DeviceNet Object,
Attribute of Instance ID = 0 (Class Attribute)

Attr. ID	Access Rule	Attribute Name	Data Type	Description	Semantics of Values
1	Get	Revision	UINT	Revision of the DeviceNet Object Class definition upon which the implementation is based.	= 2

DeviceNet Object,
Attributes of Instance ID = 1

Attr. ID	Access Rule	Attribute Name	Data Type	Description	Semantics of Values
1	Set	MAC ID	USINT	Node Address	Range 0-63
	Set is only supported if the MAC ID is programmable. Refer to *Ultra5000 Intelligent Positioning Drive Installation Manual* listed on page P-3 for Rotary DIP switch data setting.				
2	Set	Baud Rate		Data Rate	0 = 125K, 1 = 250K, 2 = 500K
	Set is only supported if the data rate is programmable. Refer to Ultra5000 Intelligent Positioning Drive Installation Manual for Rotary DIP switch data setting.				
3	Set	Bus OFF Interrupt (BOI)	BOOL	Bus-OFF Interrupt	Default = 0
4		Bus OFF Counter	USINT	Number of times Controller Area Network (CAN) went to the bus-OFF state	Range 0-255

DeviceNet Object,
Attributes of Instance ID = 1 (Continued)

Attr. ID	Access Rule	Attribute Name	Data Type	Description	Semantics of Values
5	Get	Allocation information	STRUCT of: BYTE USINT	Allocation choice (1 byte) + Master MAC ID (1 byte)	Refer to the DeviceNet Object definition in the DeviceNet Specification. Range 0-63, 255 Modified via Allocate only.
6		MAC ID Switch Changed	BOOL	The Node Address switch(es) have changed since last power-up/ reset.	0 = No change 1 = Change since last reset or power-up
7		Baud Rate Switch Changed		The Baud Rate switch(es) have changed since last power-up/ reset.	0 = No change 1 = Change since last reset or power-up
8		MAC ID Switch Value	USINT	Actual value of Node Address switch(es).	Range 0-63
9		Baud Rate Switch Value		Actual value of Baud Rate switch(es), or operating value after an autobaud was completed.	Range 0-2

DeviceNet Object,
Common Services

Service Code	Service Name	Service Description
$0E_H$	Get_Attribute_Single	Returns the contents of the specified attribute.
10_H	Set_Attribute_Single	Modifies the specified attribute.

DeviceNet Object, Class Specific Services		
Service Code	**Service Name**	**Service Description**
$4B_H$	Allocate_Master/Slave_ Connection_Set	Requests the use of the Predefined Master/Slave Connection Set.
$4C_H$	Release_Group_2_ Identifier_Set	Indicates that the specified Connections within the Predefined Master/Slave Connection Set are no longer desired. These connections are to be released (deleted).

Assembly Object (Class ID 04_H)

The Ultra5000 with DeviceNet uses Assembly Objects to send generic data to and from a Master (scanner) device over an I/O connection. The terms Input and Output are defined from the scanner's point of view:

- Output Assemblies are defined as the information that is output by the scanner and consumed by the Ultra5000.
- Input Assemblies are consumed by the scanner or are the scanner's input.

The Ultra5000 with DeviceNet allows you to choose between various Input and Output Assemblies, thereby choosing the data format of the messages that are passed back and forth between the Ultra5000 with DeviceNet and the scanner over the I/O connection. The following parameters select the Assembly Object instances that are exchanged over an I/O messaging connection.

Parameter Instance [1]	Parameter Name	Description
8	I/O Receive Select	Selects the Assembly Object instance that is updated when a Polled I/O message is received by the drive. See page 4-19 for more information.
9	I/O Transmit (Xmit) Select	Selects the Assembly Object instance that is transmitted by the drive over a Polled I/O connection. See page 4-19 for more information.

[1] Refer to the section on the Parameter Object for more information about parameter instances.

IMPORTANT If the above parameters are modified, you must perform one of the following before the modified value(s) are active:

- Close any existing I/O messaging connection.
- Power cycle the drive.
- Remove and reapply DeviceNet power to the drive.
- Reset the drive.

The following Assembly Objects are implemented in the drive and buffer I/O in the following fashion:

- RO = Read Only
- R/W = Read/Write Protected.

Assembly Object, Instance ID = 1 - 16				
ID	**Data Type**	**Access**	**Size (Bytes)**	**Description [1]**
1	Static Output	R/W	4	One Integer: DNetIntArray[2]
2	Static Output	R/W	8	Two Integers: DNetIntArray[2], DNetIntArray[3]
3	Static Output	R/W	4	One Float: DNetFltArray[2]
4	Static Output	R/W	8	Two Floats: DNetFltArray[2], DNetFltArray[3]
5	Static Output	R/W	8	One Integer, One Float: DNetIntArray[2], DNetFltArray[2]
6	Static Output	R/W	12	Two Integers, One Float: DNetIntArray[2], DNetIntArray[3], DNetFltArray[2]
7	Static Output	R/W	12	One Integer, Two Floats: DNetIntArray[2], DNetFltArray[2], DNetFltArray[3]
8	Static Output	R/W	16	Two Integers, Two Floats: DNetIntArray[2], DNetIntArray[3], DNetFltArray[2], DNetFltArray[3]
9	Static Input	RO	4	One Integer: DNetIntArray[0]
10	Static Input	RO	8	Two Integers: DNetIntArray[0], DNetIntArray[1]
11	Static Input	RO	4	One Float: DNetFltArray[0]
12	Static Input	RO	8	Two Floats: DNetFltArray[0], DNetFltArray[1]
13	Static Input	RO	8	One Integer, One Float: DNetIntArray[0], DNetFltArray[0]
14	Static Input	RO	12	Two Integers, One Float: DNetIntArray[0], DNetIntArray[1], DNetFltArray[0]
15	Static Input	RO	12	One Integer, Two Floats: DNetIntArray[0], DNetFltArray[0], DNetFltArray[1]
16	Static Input	RO	16	Two Integers, Two Floats: DNetIntArray[0], DNetIntArray[1], DNetFltArray[0], DNetFltArray[1]

[1] The arrays are automatically saved in non-volatile storage.

**Assembly Object,
Attribute of Instances ID 1 - 16**

Attr ID	Access Rule	Attribute Name	Data Type
3	Set	Data	ARRAY

**Assembly Object,
Common Services**

Service Code	Implemented for		Service Name	Service Description
	Class	Instance		
$0E_H$	Yes	Yes	Get_Attribute_Single	Returns the contents of the specified attribute.
$10E_H$	No		Set_Attribute_Single	Modifies an attribute value.

DeviceNet Comm Fault Action

The Ultra5000 with DeviceNet will fault depending on the Comm Fault Action setting if the Output (command) Assembly is not periodically updated after the Output Assembly has been written to.

You can configure the Ultra5000 with DeviceNet to perform a Comm Fault Action if the Output Assembly is not periodically updated after the I/O (or explicit) messaging connection has been established. Possible reasons the Output Assembly may not be updated in this way include the following:

- The messaging connection is closed
- The DeviceNet cable is unplugged

ATTENTION

Risk of severe bodily injury or equivalent damage exists.

The Comm Fault Action value allows you to change the default configuration, and to potentially allow the drive to continue to operate when communication with the DeviceNet Module is lost.

By default, the Ultra5000 drive with DeviceNet will fault and disable the drive when a DeviceNet Comm Fault is triggered. However, you can configure the drive to ignore the DeviceNet Comm Fault by setting the Ultra5000 DNetConfigData Array Index 4 – DeviceNet Comm Fault Action to 1 (Ignore).

DeviceNet Idle Fault Action

The Ultra5000 with DeviceNet will fault depending on the Idle Fault Action setting if the Master (scanner) sends I/O idle messages (zero-length messages) and the drive expects non-zero length I/O messages.

ATTENTION

Risk of severe bodily injury or equivalent damage exists.

The Idle Fault Action value allows you to change the default configuration, and to potentially allow the drive to continue to operate when communication with the DeviceNet Module is lost.

By default, the Ultra5000 drive with DeviceNet will fault and disable the drive when an Idle Fault is triggered. However , no action will be taken if the Ultra5000 DNetConfigData Array Index 6 – I/O Receive

Select, Parameter 8 is set to 0 (No data consumed), or if you configure the drive to ignore Array Index 3 – DeviceNet Idle Fault Action by setting the DNetConfigData array to 1 (Ignore).

Using Explicit Messaging to Control the Ultra5000

Explicit messages provide multi-purpose, point-to-point communication paths between two devices. It is possible to control the drive through explicit messaging on DeviceNet by following particular guidelines and by writing to various Assembly Objects that are buffering the I/O data. Although it is possible to control the drive by writing to various parameter objects, you should consider using a user program interfacing with the Assembly Objects for controlling the drive. The guidelines are as follows:

- Write to the various Assembly Objects that are buffering the I/O data.
- Write access to any Assembly Object is not allowed if the message is passed through a connection whose expected packet rate (EPR) is zero or if I/O data is being sent over an I/O messaging connection.
- The drive marks any explicit connection after allowing a write to an Assembly Object through the connection.
- If a marked explicit connection times out based on the EPR, then the fault action will be that for Communication Loss over the I/O connection, using Array Index 4 – DeviceNet Comm Fault Action of the DNetConfigData array.
- If a marked explicit connection is deleted, then the fault action will be that configured for Idle over the I/O connection, using Array Index 3 – DeviceNet Idle Fault Action of the DNetConfigData array.
- Multiple explicit connections can write/overwrite the control I/O if they meet the guidelines specified. Each connection will be marked individually within the drive.
- If the drive gets allocated/re-allocated by a controller such that valid I/O data is being sent to the drive, or if an Idle condition from the allocating controller is transitioned back to valid data, then all marked explicit connections will be reset to unmarked and future writes blocked.
- If a marked connection has its EPR value reset to zero (0) after being marked, then the connection will become unmarked.

Connection Object (Class ID 05_H)

The Connection Object manages the internal resources associated with both I/O and Explicit Messaging Connections. The specific instance generated by the Connection Class is referred to as a Connection Instance or a Connection Object. A Connection Object within a particular module actually represents one of the end-points of a connection.

DeviceNet Connection Object, Instance ID = 1 - 10

Instance ID	Instances
1	Group 2 Explicit Message Connection
2	Poll I/O Connection
6-10	Group 3 Explicit Message Connections

DeviceNet Connection Object, Attributes of Instances ID = 1 - 10 /

Attr ID	Access Rule	Attribute Name	Data Type	Description
1	Get	State	USINT	State of the Connection
2		Instance Type		I/O or Message Connection
3		Transport_class_trigger	BYTE	Defines the behavior of the Connection
4		Produced_connection_id	UINT	CAN identifier to transmit on
5		Consumed_connection_id		CAN identifier to receive on
6		Initial_comm_characteristics	BYTE	Defines the Message Group(s) associated with this Connection
7		Produced_connection_size	UINT	Maximum number of bytes transmitted across this Connection
8		Consumed_connection_size		Maximum number of bytes received across this Connection
9	Set	Expected_packet_rate		Defines timing associated with this Connection
12		Watchdog_timeout_action	USINT	Defines how to handle Inactivity/Watchdog timeouts
13	Get	Produced_connection_path_ length	UINT	Number of bytes in the produced_connection_path attribute
14		Produced_connection_path	EPATH	Specifies the Application Object whose data is to be produced by this Connection object
15		Consumed_connection_path_length	UINT	Number of bytes in the Consumed_connection_path attribute
16		Consumed_connection_path	EPATH	Specifies the Application Object(s) that are to receive the data consumed by this Connection
17	Set	Production_inhibit_time	UINT	Defines minimum time between new data production for COS connections.

DeviceNet Connection Object, Common Services

Service Code	Service Name	Service Description
$0E_H$	Get_Attribute_Single	Returns the contents of the specified attribute.
10_H	Set_Attribute_Single	Modifies the specified attribute.
05_H	Reset	Used to reset the Inactivity/Watchdog Timer associated with a Connection Object

Parameter Object (Class ID $0F_H$)

The DeviceNet Parameter Object provides the interface to the Ultra5000 Drive with DeviceNet configuration data. It supplies a full description of the parameter, including its minimum and maximum values and a readable text string describing the parameter. The instances start at one and increment with no gaps.

Parameter Object, Attributes for Instance ID = 0 (Class Attributes)

Attr ID	Access Rule	Name	Data Type	Description	Semantics of Values
1	Get	Revision	UINT	Revision of this object	Current value = 01
2		Max Instances		Maximum instance number of an object currently created in this class level of the device	The largest instance number of a created object at this class hierarchy level
8		Parameter Class Descriptor	WORD	Bit field that describe parameters	Bit 0 = supports parameter instances Bit 1 = full attributes Bit 2 = nonvolatile storage save command Bit 3 = params are stored in nonvolatile storage
9		Configuration Assembly Instance	UINT	Instance number of the configuration assembly	0 = configuration assembly not supported

The table *Parameter Instance* on page 4-18 lists the parameter instances implemented in the Ultra5000 Drive with DeviceNet. The table *Parameter Object Instance Attributes* on page 4-49 lists the instance attributes of the parameter object. A parameter value is accessed via Attribute 1 of a parameter instance. Additional information about the parameter object is located beginning on Page 4-51.

IMPORTANT Some parameters can not be modified while the Ultra5000 Drive with DeviceNet is enabled. The drive returns the error code, 10_h - Device State Conflict, if you attempt to modify one of these parameters while the drive is enabled.

Note: The Set_Attribute_Single service saves parameter values to RAM, but not to non-volatile storage. To transfer parameter values from RAM to non-volatile storage, perform one of the following:

- Perform the Save service on the Parameter Object.
- Write the value Execute Command (1) to Parameter 13 - Save Parameter Values.

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
1	Get	DNet Main Firmware Version	SHORT_STRING	1 byte length indicator, 1 byte per character		The version of the main firmware in the DeviceNet adapter. The format is XX.YY.ZZ, where: XX = major revision YY = minor revision ZZ = maintenance revision
2	Get	DNet Boot Firmware Version	SHORT_STRING	1 byte length indicator, 1 byte per character		The version of the boot firmware in the adapter. The format is XX.YY.ZZ, where: XX = major revision YY = minor revision ZZ = maintenance revision
3	Get	Drive Model	SHORT_STRING	1 byte length indicator, 1 byte per character		The model number of the drive.
4	Get	DN-SW Node Address	USINT	1		DeviceNet Node Address (Mac_ID) switch setting.
5	Get	DN-SW Data Rate	USINT	1		DeviceNet Data Rate switch setting. 0 = 125 kps 1 = 250 kps 2 = 500 kps 3 = Autobaud 4 = Program 5 = Programmable 6 = Programmable 7 = Programmable
6	Set	DN-NV Node Address	USINT	1		The programmed nonvolatile DeviceNet Node Address (Mac_ID). Range: 0 to 63 Default: 63 Automatically saved in non-volatile storage.
7	Set	DN-NV Data Rate	USINT	1		The programmed nonvolatile DeviceNet Data Rate. 0 = 125 kps (default) 1 = 250 kps 2 = 500 kps 3 = Autobaud Automatically saved in non-volatile storage.

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
8	Set	I/O Receive Select	USINT	1		Selects the output (consumed) assembly that is updated when a polled I/O message is received by the drive. If the value is modified, the user has to either, close any existing I/O messaging connection(s), power cycle the drive, reset the drive, or remove and reapply DeviceNet power for the drive to use the modified value. Refer to the Assembly Object for information on the data format. 0 = No Data Consumed 1 = Assembly Instance 1 (default) 2 = Assembly Instance 2 3 = Assembly Instance 3 4 = Assembly Instance 4 5 = Assembly Instance 5 6 = Assembly Instance 6 7 = Assembly Instance 7 8 = Assembly Instance 8 Automatically saved in non-volatile storage.
9	Set	I/O Transmit (Xmit) Select	USINT	1		Selects the input (produced) assembly that is transmitted by the drive over a polled I/O messaging connection. If the value is modified, the user has to either, close any existing I/O messaging connection(s), power cycle the drive, reset the drive, or remove and reapply DeviceNet power for the drive to use the modified value. Refer to the Assembly Object for information on the data format. 0 = No Data Produced 1 = Assembly Instance 9 (default) 2 = Assembly Instance 10 3 = Assembly Instance 11 4 = Assembly Instance 12 5 = Assembly Instance 13 6 = Assembly Instance 14 7 = Assembly Instance 15 8 = Assembly Instance 16 Automatically saved in non-volatile storage.
10	Set	Axis Enable Command	USINT	1		Enable the drive. 0 = No Action (default) 1 = Execute Command
11	Set	Disable Axis Command	USINT	1		Disable the drive. 0 = No Action (default) 1 = Execute Command
12	Set	Reset Drive	USINT	1		Reset the drive. 0 = No Action (default) 1 = Execute Command
13	Set	Save Parameter Values	USINT	1		Save parameters in non-volatile storage. 0 = No Action (default) 1 = Execute Command

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
14	Set	Control Digital Type	USINT	1		Select a digital I/O type: 0 = Sourcing: Digital Inputs should be connected to a 24 volt power supply, so current flows into the drive when the input is ON. Digital Outputs should be connected to ground, so current flows from the drive when the output is ON. (default) 1 = Sinking: Digital Inputs should be connected to ground, so current flows from the drive when the input is ON. Digital Outputs should be connected to a 24 volt power supply, so current flows into the drive when the output is ON.
15	Get	Axis State	USINT	1		Indicates if the axis is enabled or disabled. 0 = Disabled 1 = Enabled
16	Get	Controller Fault	USINT	1		Provides the fault status of the drive. 0 = No Fault 4 = Motor Overtemperature 5 = IPM Fault 9 = Bus Undervoltage 10 = Bus Overvoltage 11 = Bad (Illegal) Hall State 14 = Network Communication 17 = User Current 18 = Overspeed 19 = Position (Following) Error 20 = Motor Encoder Error 21 = Auxiliary Encoder Error 22 = Motor Filter 23 = IPM Filter 24 = Velocity Error 26 = User Velocity 58 = Excess CPU Load
17	Get	Controller State	USINT	1		Provides the state of the controller. 0 = Idle 1 = Running 2 = Erasing 3 = Programming 4 = FlashFault
18	Get	Average Current	REAL	4	Amps	Average current.
19	Get	Torque Command	REAL	4	Amps	Torque command.
20	Get	Torque Feedback	REAL	4	Amps	Torque feedback.
21	Get	Torque Error	REAL	4	Amps	Torque error.

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
22	Set	Enable Position Limit	USINT	1		Enables the position limits. This causes the drive to start monitoring the position limits. The Position Limit State - Parameter 34 will transition to "Running". 0 = No Action (default) 1 = Execute Command
23	Set	Disable Position Limit	USINT	1		Disables the position limits. This causes the drive to stop monitoring the position limits. The Position Limit State - Parameter 34 will transition to "Disabled". 0 = No Action (default) 1 = Execute Command
24	Set	Reset Position Limit	USINT	1		After a position limit violation, the position limits will go to the "Stopped" state. The drive will not allow commanded motion in this state. Pressing this button will allow the drive to respond to commanded motion to back off of the limit condition. 0 = No Action (default) 1 = Execute Command
25	Set	Position Limit Decel	REAL	4	cnts/ sec^2	When a limit is detected, the drive will use this deceleration rate to bring the axis to a stop, unless doing so would violate the Position Limit Distance - Parameter 26. If necessary to stay within the Position Limit Distance, the drive will calculate a greater deceleration rate. Range: 0 to 3.4e10 Default: 0
26	Set	Position Limit Distance	DINT	4	cnts	When a limit is detected, the drive will bring the axis to a stop within this distance. Range: 0 to 2147483647 Default: 0
27	Set	Position Soft Limits	USINT	1		Enables or disables detection of soft limit violations. The Position Limits (see Enable Position Limit - Parameter 22) must also be enabled for soft limit violations to be detected. Not saved in non-volatile memory. 0 = Disable (default) 1 = Enable

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
28	Set	Position Hard Limits	USINT	1		Enables or disables detection of hard limit violations. The Position Limits (see Enable Position Limit - Parameter 22) must also be enabled for hard limit violations to be detected. The inputs to use for positive and negative hard limits must be set (see Parameters 32 and 33 below) for the hard limits to be detected. Not saved in non-volatile memory. 0 = Disable (default) 1 = Enable Note: Hard limits are enabled on power-up if either hard limit is assigned.
29	Set	Position Motor Limits	USINT	1		Enables or disables detection of motor integral limit violations. The Position Limits (see Enable Position Limit - Parameter 22) must also be enabled for motor limit violations to be detected. The motor limits will only work when using a motor that supports integral limits (see Parameter 249). Not saved in non-volatile memory. 0 = Disable (default) 1 = Enable Note: Motor limits are enabled on power-up if Integral Limits - Parameter 249 are enabled on the motor.
30	Set	Position Positive Soft Limit	DINT	4	cnts	The position, in counts, when a positive soft limit violation will be detected by the drive. This is the point where the drive will begin decelerating the axis. Range: -2147483648 to 2147483647 Default: 0
31	Set	Position Negative Soft Limit	DINT	4	cnts	The position, in counts, when a negative soft limit violation will be detected by the drive. This is the point where the drive will begin decelerating the axis. Range: -2147483648 to 2147483647 Default: 0

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
32	Set	Position Positive Hard Limit	USINT	1		The selected digital input to use to indicate a positive hard limit violation. The drive will begin decelerating the axis when the input becomes active. 0 = Unassigned (default) 1 = Input 1 2 = Input 2 3 = Input 3 4 = Input 4 5 = Input 5 6 = Input 6 7 = Input 7 8 = Input 8 9 = Input 9 10 = Input 10 11 = Input 11 12 = Input 12 13 = Input 13 14 = Input 14 15 = Input 15 16 = Input 16
33	Set	Position Negative Hard Limit	USINT	1		The selected digital input to use to indicate a negative hard limit violation. The drive will begin decelerating the axis when the input becomes active. 0 = Unassigned (default) 1 = Input 1 2 = Input 2 3 = Input 3 4 = Input 4 5 = Input 5 6 = Input 6 7 = Input 7 8 = Input 8 9 = Input 9 10 = Input 10 11 = Input 11 12 = Input 12 13 = Input 13 14 = Input 14 15 = Input 15 16 = Input 16

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
34	Get	Position Limit State	USINT	1		State of the position limit function. 0 = Disabled – Position Limits are not being monitored. 1 = Enabling – The drive is transitioning from the Disabled state to Running. 2 = Running – The drive is monitoring position limits. 3 = Stopping – The drive has detected a limit violation and is decelerating the motor. 4 = Stopped – The motor has been stopped in response to a limit violation. The drive will not allow any commanded motion until the Position Limits are reset. 5 = Resetting – The drive is transitioning from the Stopped state to Running.
35	Get	Position Limit Flags	DWORD	4		Indicates which position limit violation(s) have been detected. Bit 0 = Positive Soft Limit Bit 4 = Positive Hard Limit Bit 8 = Positive Motor Limit Bit 16 = Negative Soft Limit Bit 20 = Negative Hard Limit Bit 24 = Position Motor Limit
36	Set	Jog Forward Command	USINT	1		Spins the motor at the Jog Program Velocity - Parameter 40 in the forward direction. 0 = No Action (default) 1 = Execute Command
37	Set	Jog Reverse Command	USINT	1		Spins the motor at the Jog Program Velocity - Parameter 40 in the reverse direction. 0 = No Action (default) 1 = Execute Command
38	Set	Jog Stop Command	USINT	1		Brings the motor to a stop, using the Jog Program Decel - Parameter 42 rate. 0 = No Action (default) 1 = Execute Command
39	Set	Jog Abort Command	USINT	1		Brings the motor to an immediate stop. 0 = No Action (default) 1 = Execute Command
40	Set	Jog Program Velocity	REAL	4	cnts/ sec	The commanded motor velocity when the drive is jogging. Not saved in non-volatile memory. Range: -3.4e10 to 3.4e10 Default: 0
41	Set	Jog Program Accel	REAL	4	cnts/ sec^2	The acceleration rate used when ramping-up to the Jog Program Velocity. Not saved in non-volatile memory. Range: 0 to 3.4e10 Default: 0

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
42	Set	Jog Program Decel	REAL	4	cnts/ sec^2	The deceleration rate used when ramping-down from Jog Program Velocity to zero. Not saved in non-volatile memory. Range: 0 to 3.4e10 Default: 0
43	Get	Jog State	USINT	1		Describes the relation between the Jog Program Velocity and Jog Current Velocity, as follows: 0 = Locked, when Jog Current Velocity equals Jog Program Velocity. 1 = Seeking, when the jog is accelerating or decelerating.
44	Get	Jog Mode	USINT	1		Describes the direction of the drive's jog, as follows: 0 = Stopped, when not jogging 1 = Forward, when jogging forward 2 = Reverse, when jogging in reverse
45	Get	Jog Current Position	DINT	4	cnts	The position generated by the current jog. This value is automatically re-set to zero at drive power up.
46	Get	Jog Current Velocity	REAL	4	cnts/ sec	The velocity command generated by the current jog.
47	Get	Jog Current Accel	REAL	4	cnts/ sec^2	The acceleration command generated by the current jog.
48	Set	Move Start Command	USINT	1		Starts a trapezoidal move defined by the Move Program Distance, Move Program Velocity, Move Program Accel, and Move Program Decel (see Parameters 51, 52, 53, and 54 below). 0 = No Action (default) 1 = Execute Command
49	Set	Move Stop Command	USINT	1		Brings the motor to a stop, using the Move Program Decel. 0 = No Action (default) 1 = Execute Command
50	Set	Move Abort Command	USINT	1		Brings the motor to an immediate stop. 0 = No Action (default) 1 = Execute Command to an immediate stop.
51	Set	Move Program Distance	DINT	4	cnts	The distance that the motor is to move when a Move Start Command is executed. Not saved in non-volatile memory. Range: -2147483648 to 2147483647 Default: 0
52	Set	Move Program Velocity	REAL	4	cnts/ sec	The commanded motor velocity during a move. Range: -3.4e10 to 3.4e10 Not saved in non-volatile memory. Default: 0

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
53	Set	Move Program Accel	REAL	4	cnts/ sec^2	The acceleration rate used when ramping-up to the move's velocity. Not saved in non-volatile memory. Range: 0 to 3.4e10 Default: 0
54	Set	Move Program Decel	REAL	4	cnts/ sec^2	The deceleration rate used when ramping-down from the move's velocity to zero. Not saved in non-volatile memory. Range: 0 to 3.4e10 Default: 0
55	Get	Move State	USINT	1		Describes the state of the Move function. 0 = Idle 1 = Profiling 2 = Calculating 3 = Correcting
56	Get	Move Floating Zero	DINT	4	cnts	In the event that the Move Current Position value is changed by the execution of a program (.exe) file, the value of this field will change so that the sum of Move Floating Zero and Move Current Position remains unchanged.
57	Get	Move Current Position	DINT	4	cnts	The position generated by the current move. This value is automatically re-set to zero at drive power up.
58	Get	Move Current Velocity	REAL	4	cnts/ sec	The velocity command generated by the current move
59	Get	Move Current Accel	REAL	4	cnts/ sec^2	The acceleration command generated by the current move.
60	Get	Move Current Jerk	REAL	4	cnts/ sec^3	The rate of change of acceleration generated by the current move.
61	Set	Camtable Load	USINT	1		Loads the cam file specified by Camtable Filename into memory. 0 = No Action (default) 1 = Execute Command
62	Set	Camtable Unload	USINT	1		Unloads the cam file from memory. This frees drive memory. 0 = No Action (default) 1 = Execute Command

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
63	Set	Camtable Filename	SHORT_STRING	1 byte length indicator, 1 byte per character		The filename (up to 32 characters) describing the cam motion. Ultraware generates Cam files when you insert a cam table under the "Cam" branch in the workspace. The cam files generated by Ultraware are always stored in the drives flash file system under a directory named /Cam.dir. If a cam table is created in Ultraware with the default name of Table.cam, and loaded into drive memory, the File Name will be "/Cam.dir/Table.cam". User programs may set the Camtable Filename attribute to different paths.
64	Set	Cam Enable Command	USINT	1		Causes the cam to begin generating an output position. A cam table file must be loaded to enable cam, or an "Invalid State" error occurs. 0 = No Action (default) 1 = Execute Command
65	Set	Cam Disable Command	USINT	1		Causes the cam to stop generating output, but the Cam Current Position output is held constant at the current value. 0 = No Action (default) 1 = Execute Command
66	Get	Cam State	USINT	1		The current state of the cam: 0 = Disabled 1 = Enabled
67	Get	Cam Input Position	DINT	4	cnts	The current master position value. This value will roll over to zero as it passes the Camtable Length value.
68	Get	Cam Input Velocity	REAL	4	cnts/ sec	The current master velocity value.
69	Get	Cam Current Position	DINT	4	cnts	The output position of the cam. This position always corresponds to the output position defined for the given "Input Position" in the cam table. If the cam ends at a non-zero output position, this value will roll back to zero (where all cams start), and the Cam Offset status will be incremented by the difference between the starting and stopping output positions for the cam table. The actual position command generated by the cam is the sum of the Cam Offset and Cam Current Position.
70	Get	Cam Current Velocity	REAL	4	cnts/ sec	The actual velocity command generated by the cam. This value will be equal to the Cam Input Velocity multiplied by the instantaneous cam table velocity, which is the rate of change of the cam position.

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
71	Get	Cam Current Accel	REAL	4	cnts/ sec^2	The actual acceleration command generated by the cam. This value will be equal to the instantaneous cam table acceleration, which is the rate of change of the cam times the Cam Input Velocity.
72	Get	Cam Index	DINT	1		The segment of the cam table used to calculate the cam output. This is determined by the Cam Input Position. The index is zero based.
73	Get	Cam Offset	DINT	4	cnts	The value, in counts, necessary to adjust the cam between its final output position and the output position for the beginning of the next cam cycle. A cam wraps around to start again at its beginning, if there is a difference between the final and beginning output position of the cam table, the offset is adjusted by the difference, so the Cam Current Position is always the actual output position described by the cam table
74	Get	Camtable State	USINT	1		The current cam memory load status: 0 = Unloaded - a cam file is not loaded into memory. 1 = Loaded - a cam file has been loaded into memory. Note: The Camtable Filename attribute can be changed by a user program (or DeviceNet) after a cam file is loaded, so the filename displayed doesn't have to be the name of the file that is loaded.
75	Get	Camtable Mode	USINT	1		The current mode of the cam: 0 = Unlocked - the cam table is inactive, and a cam file may be loaded into memory. 1 = Locked - the cam is active, and a different cam file cannot be loaded. The Cam Table is "Locked" whenever the Cam is enabled.
76	Get	Camtable Count	DINT	4		The number of segments in the loaded cam table. A cam table is divided into segments that start at each point defined in the cam file (except the final point displayed in the Ultraware Cam table interface, which is only used to define the end of the previous segment, not the start of a segment.)

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
77	Get	Camtable Order	DINT	4		Each of the segments of an Ultra5000 cam table is defined by a polynomial equation, such as: Output position = A + B*(Input Position) +C*(Input Position)^2 +… The Camtable Order is the highest order term in the right side of this equation. All of the segments in a cam table must have the same order. When Ultraware generates a cam file it generates first order equations when the cam table is a linear type, and 5th order equations when the cam table is a polynomial type. A 5th order polynomial provides sufficient degrees-of-freedom to allow Ultraware to constrain the positions, velocities, and accelerations at the ends of each segment.
78	Get	Camtable Length	DINT	4	cnts	The maximum value of Cam Input Position in the cam table.
79	Get	Camtable Offset	DINT	4	cnts	The ending output position defined in the cam table.
80	Set	Gear Enable Command	USINT	1		Causes the gear to begin generating output - and motion - in response to input received from the Master Encoder (or ratchet). 0 = No Action (default) 1 = Execute Command
81	Set	Gear Disable Command	USINT	1		Causes the gear to stop generating output. 0 = No Action (default) 1 = Execute Command
82	Set	Gear Ratio	REAL	4		The number of counts the motor should move for each master encoder count received (in Motor Counts per Master Count). Not saved in non-volatile memory. Range: -2147483520 to 2147483520 Default: 0
83	Set	Gear Slew	USINT	1		If “Enabled”, the gear ratio will ramp up or down using the acceleration and deceleration specified below. If “Disabled” the acceleration and deceleration are effectively infinite. 0 = Disable (default) 1 = Enable
84	Set	Gear Slew Accel	REAL	4	ratio/ sec	If the gear is enabled while the gear input is in motion, or the gear ratio is changed to a greater value. The gear ratio will ramp up to the specified value at this rate. Range: 0 to 3.4e10 Default: 0

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
85	Set	Gear Slew Decel	REAL	4	ratio/ sec	If the gear is disabled while it is in motion, or the gear ratio is changed to a smaller value. The gear ratio will ramp down to the specified value (or zero if disabling) at this rate. Range: 0 to 3.4e10 Default: 0
86	Get	Gear State	USINT	1		Indicates if the gear is enabled and generating output. 0 = Disable 1 = Enable
87	Get	Gear Offset	REAL	4	cnts	The floating point value of the Gear Current Position.
88	Get	Gear Current Position	DINT	4	cnts	The position generated by gearing. This value is automatically re-set to zero at drive power up.
89	Get	Gear Current Velocity	REAL	4	cnts/ sec	The velocity command generated by gearing.
90	Get	Gear Current Accel	REAL	4	cnts/ sec^2	The acceleration command generated by gearing.
91	Get	Gear Slew State	USINT	1		Indicates if the gear ratio is changing. 0 = Locked - The gear ratio has reached the target value. 1 = Seeking - The gear ratio is ramping up or down.
92	Get	Current Gear Ratio	REAL	4		The current gear ratio may not equal the user entered Gear Ratio when the Gear Slew State = Seeking. The current gear ratio is equal to the user entered Gear Ratio when the Gear Slew State = Locked, or if Gear Slew is Disabled.
93	Set	Vreg KP	REAL	4	1/sec	Proportional gain for the velocity loop. Increasing the P gain improves response time and increases the “stiffness” of the system. Too high a P gain value causes instability; too low a P gain value results in “loose” or “sloppy” system dynamics. Range: 0 to 3.4e10 Default: 200
94	Set	Vreg KI	REAL	4	1/sec	Integral gain for the velocity loop. I gain improves the steady-state velocity performance of the system. Increasing the integral gain generally increases the ultimate positioning accuracy of the system. However excessive integral gain results in system instability Range: 0 to 3.4e10 Default: 0
95	Set	Vreg KFF	REAL	4		Acceleration feedforward gain. FF gain reduces velocity following error. However, high values can cause velocity overshoot Range: 0 to 3.4e10 Default: 1

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
96	Set	Vreg Bandwidth	REAL	4	Hertz	Lowpass output filter bandwidth. Valid values range from 0 Hz to 2000 Hz. Bandwidth reduces noise generated by encoder resolution or mechanical resonance in the system. Setting to zero disables filtering Range: 0 to 2000 Default: 0
97	Set	Vreg Upper Limit	REAL	4	Amps	The maximum positive current the drive may output to the motor. Range: 0 to 3.4e10 Default: 30
98	Set	Vreg Lower Limit	REAL	4	Amps	The maximum negative current the drive may output to the motor. Range: -3.4e10 to 0 Default: -30
99	Get	Vreg Command Velocity	REAL	4	cnts/ sec	The command velocity input to the velocity loop.
100	Get	Vreg Command Accel	REAL	4	cnts/ sec^2	The command acceleration input to the velocity loop.
101	Get	Vreg Feedback Velocity	REAL	4	cnts/ sec	The feedback velocity returned from the motor to the velocity loop.
102	Get	Vreg Error	REAL	4	cnts/ sec	The difference between Command Velocity and Feedback Velocity.
103	Get	Vreg Error Sum	REAL	4	cnts/ sec	The velocity error summation used by integral gain.
104	Get	Vreg Output	REAL	4	Amps	The generated output from the velocity loop.
105	Get	Vreg Tune State	USINT	1		Indicates the state of the velocity tuning function. 0 = Idle 1 = Running 2 = Stopping
106	Set	Start Vreg Tune	USINT	1		Drives the motor with a square(or step) wave, the shape of which is determined by the commanded Vreg Tune Step, Vreg Tune Period, and Vreg Tune Direction. 0 = No Action (default) 1 = Execute Command
107	Set	Stop Vreg Tune	USINT	1		Stops velocity tuning. 0 = No Action (default) 1 = Execute Command

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
108	Set	Vreg Tune Direction	USINT	1		Selects a tuning direction. Not saved in non-volatile memory. 0 = Bi-Directional (default) - to tune the drive using an alternating step-input to create alternately forward and reverse directional motion. 1 = Forward Only - to tune the drive using a step-input to create forward motion only. 2 = Reverse Only - Only to tune the drive using a step-input to create reverse motion only.
109	Set	Vreg Tune Period	REAL	4	sec	The time the drive will turn at a given velocity. Not saved in non-volatile memory. Range: 0 to 3.4e10 Default: 0
110	Set	Vreg Tune Step	REAL	4	cnts/ sec	The amplitude of the velocity input sent to the drive for the given Vreg Tune Period. In Bi-Directional tuning, the amplitude will alternate polarity (+ or - sign). Not saved in non-volatile memory. Range: 0 to 3.4e10 Default: 0
111	Get	Vreg Tune Command	REAL	4	cnts/ sec	The velocity command driving the velocity regulator while the velocity tuning algorithm is running. This signal is only included to be consistent with the Position Regulator Tune Command signal. It is actually the same as the Vreg Command Velocity.
112	Get	Vreg Tune Feedback	REAL	4	cnts/ sec	The velocity feedback to the velocity regulator while the velocity tuning algorithm is running. This signal is only included to be consistent with the Position Regulator Tune Feedback signal. It is actually the same as the Vreg Feedback Velocity.
113	Set	Preg Kp	REAL	4	1/sec	Proportional gain for the position loop. Increasing the Kp gain improves response time and increases the “stiffness” of the system. Too high a Kp gain value causes instability; too low a Kp gain value results in “loose” or “ sloppy” system dynamics. Range: 0 to 3.4e10 Default: 20
114	Set	Preg Kpz	REAL	4	1/sec	Proportional gain for the position loop, when the position error falls within the Preg Kpz Zone. Range: 0 to 3.4e10 Default: 0
115	Set	Preg Kpz Zone	DINT	4	cnts	Enter the region, in counts, around Command Position where Preg Kpz will be used in place of Preg Kp as the position loop proportional gain value. Range: 0 to 2147483647 Default: 0

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
116	Set	Preg Ki	REAL	4	1/sec	Integral gain for the position loop. Ki gain improves the steady-state positioning performance of the system and virtually eliminates steady-state positioning errors. Increasing the integral gain generally increases the ultimate positioning accuracy of the system. However excessive integral gain results in system instability. Range: 0 to 3.4e10 Default: 0
117	Set	Preg Ki Zone	DINT	4	cnts	Enter the region, in counts, around Preg Command Position where integral gain is active. Range: 0 to 2147483647 Default: 0
118	Set	Preg Kff	REAL	4		Velocity feedforward gain for the position loop. Range: 0 to 3.4e10 Default: 1
119	Get	Preg Command Position	DINT	4	cnts	The command position input to the position loop.
120	Get	Preg Command Velocity	REAL	4	cnts/ sec	The command velocity input to the position loop.
121	Get	Preg Command Accel	REAL	4	cnts/ sec^2	The command acceleration input to the position loop.
122	Get	Preg Feedback Position	DINT	4	cnts	The feedback position returned from the motor to the position loop.
123	Get	Preg Error	DINT	4	cnts	The difference between Preg Command Position and Preg Feedback Position.
124	Get	Preg Error Sum	DINT	4	cnts	The position error summation used by integral gain.
125	Get	Preg Output	REAL	4	cnts/ sec	The generated output from the position loop.
126	Get	Preg Tune State	USINT	1		Indicates the state of the position tuning function. 0 = Idle 1 = Running 2 = Stopping
127	Get	Preg Command Offset	DINT	4	cnts	Offsets the Command Position value displayed on Ultraware's Oscilloscope to prevent the command trace from incrementing ('walking') off the display.
128	Get	Preg Feedback Offset	DINT	4	cnts	Offsets the Feedback Position value displayed on the Ultraware's Oscilloscope to prevent the feedback trace from incrementing ('walking') off the display.

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
129	Set	Start Preg Tune	USINT	1		Drives the motor with a square(or step) wave, the shape of which is determined by the commanded Preg Tune Step, Preg Tune Period, and the selected Preg Tune Direction. 0 = No Action (default) 1 = Execute Command
130	Set	Stop Preg Tune	USINT	1		Stops position tuning. 0 = No Action (default) 1 = Execute Command
131	Set	Preg Tune Direction	USINT	1		Selects a tuning direction. Not saved in non-volatile memory. 0 = Bi-Directional (default) - to tune the drive using an alternating step-input to create alternately forward and reverse directional motion. 1 = Forward Only - to tune the drive using a step-input to create forward motion only. 2 = Reverse Only - Only to tune the drive using a step-input to create reverse motion only.
132	Set	Preg Tune Period	REAL	4	sec	The time the drive will hold its present step position. Not saved in non-volatile memory. Range: 0 to 3.4e10 Default: 0
133	Set	Preg Tune Step	DINT	4	cnts	The number of counts the drive will move in a single direction. In Bi-Directional tuning, the direction will alternate. Not saved in non-volatile memory. Range: 0 to 2147483647 Default: 0
134	Get	Preg Tune Command	DINT	4	cnts	The position command driving the position regulator while the position tuning algorithm is running. If the Preg Tune Direction is set to c or Reverse Only, this signal is adjusted after each period of the tuning signal to remove the offset that is accumulating in the position of the motor. This allows the uni-directional signal to be displayed in Ultraware's oscilloscope without having to constantly adjust the offset.
135	Get	Preg Tune Feedback	DINT	4	cnts	The position feedback to the position regulator while the position tuning algorithm is running. If the Preg Tune Direction is set to Forward Only or Reverse Only, this signal is adjusted after each period of the tuning signal to remove the offset that is accumulating in the position of the motor. This allows the uni-directional signal to be displayed in Ultraware's oscilloscope without having to constantly adjust the offset.

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
136	Set	Motor Encoder Interpolation	UINT	2		The amount of interpolation to be used with sine/cosine encoders. For example, if the interpolation is set to x256, the drive will interpolate 256 counts for every 1/4 line of the input sinusoid. Valid values are: 4 = x4 (default) 8 = x8 16 = x16 32 = x32 64 = x64 128 = x128 256 = x256 512 = x512 1024 = x1024
137	Set	Motor Encoder Polarity	USINT	1		Select the motor encoder's polarity. 0 = Positive (default) - Turning the motor in a clockwise direction (as viewed from the shaft end) increases the feedback position (in counts). 1 = Negative - turning the motor in a clockwise direction (as viewed from the shaft end) decreases the feedback position (in counts).
138	Set	Motor Encoder Filter	USINT	1		Select the state of the motor encoder filer. The filter reduces the upper limit of the rate at which feedback pulses will be recognized. You may need to enable feedback in a noisy environment, or when a long encoder cable is used. 0 = Disable (default) 1 = Enable
139	Set	Master Encoder Polarity	USINT	1		Select the master encoder's polarity. 0 = Positive (default) - Turning the motor in a clockwise direction (as viewed from the shaft end) increases the feedback position (in counts). 1 = Negative
140	Set	Master Encoder Filter	USINT	1		Select the state of the master encoder filter. The filter reduces the upper limit of the rate at which feedback pulses will be recognized. You may need to enable feedback in a noisy environment, or when a long encoder cable is used. 0 = Disable (default) 1 = Enable

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
141	Set	Ratchet Negative Mode	BYTE	1		Bit 0 = Ignore Negative Input - Negative direction master encoder input will generate NO motor movement Bit 1 = Negate Negative Input - Master encoder input in a negative direction will generate motor movement in a positive direction. Note: Selecting "Ignore Negative Input", above, overrides this selection Bit 2 = Buffer Negative Input - Negative direction master encoder input is accumulated in a buffer without generating motor movement. Note: This selection will often be used together with "Unbuffer Positive Input", below Bit 3 = Unbuffer Negative Input - Negative direction master encoder input will be used first to reduce the accumulated positive directional buffer then, only after this buffer is reduced to zero, will generate motor movement in the negative direction. Note: This assumes "Buffer Negative Input", above, is not selected. Default = 0

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
142	Set	Ratchet Positive Mode	BYTE	1		Bit 0 = Ignore Positive Input - Positive direction master encoder input will generate NO motor movement. Bit 1 = Negate Positive Input - Master encoder input in a positive direction will generate motor movement in a negative direction. Note: Selecting "Ignore Positive Input", above, overrides this selection. Bit 2 = Buffer Positive Input - Positive direction master encoder input is accumulated in a buffer without generating motor movement. Note: This selection will often be used together with "Unbuffer Negative Input", above. Bit 3 = Unbuffer Positive Input - Positive direction master encoder input will be used first to reduce the accumulated negative directional buffer then, only after this buffer is reduced to zero, will generate motor movement in the positive direction. Note: This assumes "Buffer Positive Input", above, is not selected Default = 0.
143	Get	Motor Encoder Output	DINT	4	cnts	The motor encoder's output.
144	Get	Master Encoder Output	DINT	4	cnts	The master encoder's output.
145	Get	Ratchet State	USINT	1		Provides the state of the ratchet. 0 = Disable 1 = Enable
146	Get	Ratchet Buffer	DINT	4	cnts	The accumulated value stored in the buffer when negative or positive input is set to buffer and/or unbuffer. This value is automatically re-set to zero at drive power up.
147	Get	Ratchet Output	DINT	4	cnts	The position generated by the ratchet. This value is automatically re-set to zero at drive power up.
148	Get	Ratchet Position	DINT	4	cnts	The position generated by the ratchet. This value is automatically reset to zero at power up.
149	Get	Ratchet Velocity	REAL	4	cnts/ sec	The velocity command generated by the ratchet.
150	Get	Input 1 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
151	Get	Input 2 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
152	Get	Input 3 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
153	Get	Input 4 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
154	Get	Input 5 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
155	Get	Input 6 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
156	Get	Input 7 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
157	Get	Input 8 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
158	Get	Input 9 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
159	Get	Input 10 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
160	Get	Input 11 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
161	Get	Input 12 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
162	Get	Input 13 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
163	Get	Input 14 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
164	Get	Input 15 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
165	Get	Input 16 State	USINT	1		The current state, or condition, of the digital input. 0 = Off 1 = On
166	Set	Output 1 State	USINT	1		The current state, or condition, of the digital output. Not saved in non-volatile memory. 0 = Off (default) 1 = On
167	Set	Output 2 State	USINT	1		The current state, or condition, of the digital output. Not saved in non-volatile memory. 0 = Off (default) 1 = On
168	Set	Output 3 State	USINT	1		The current state, or condition, of the digital output. Not saved in non-volatile memory. 0 = Off (default) 1 = On
169	Set	Output 4 State	USINT	1		The current state, or condition, of the digital output. Not saved in non-volatile memory. 0 = Off (default) 1 = On
170	Set	Output 5 State	USINT	1		The current state, or condition, of the digital output. Not saved in non-volatile memory. 0 = Off (default) 1 = On
171	Set	Output 6 State	USINT	1		The current state, or condition, of the digital output. Not saved in non-volatile memory. 0 = Off (default) 1 = On
172	Set	Output 7 State	USINT	1		The current state, or condition, of the digital output. Not saved in non-volatile memory. 0 = Off (default) 1 = On

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
173	Set	Output 8 State	USINT	1		The current state, or condition, of the digital output. Not saved in non-volatile memory. 0 = Off (default) 1 = On
174	Set	ADC 1 Scale	REAL	4		A multiplier applied to the voltage read at analog input 1. Range: -3.4e10 to 3.4e10 Default: 1
175	Set	ADC 1 Offset	REAL	4	Volts	A value added to the multiplied ADC 1 input. Range: -3.4e10 to 3.4e10 Default: 0
176	Get	ADC 1 Input	REAL	4	Volts	The scaled value of analog input 1. This value equals the voltage read at the analog input multiplied by the gain value, summed with the offset.
177	Get	ADC 1 Output	REAL	4	Volts	The unscaled value of analog input 1. This value equals the voltage read at the analog input.
178	Set	ADC 2 Scale	REAL	4		A multiplier applied to the voltage read at analog input 2. Range: -3.4e10 to 3.4e10 Default: 1
179	Set	ADC 2 Offset	REAL	4	Volts	A value added to the multiplied ADC 2 input. Range: -3.4e10 to 3.4e10 Default: 0
180	Get	ADC 2 Input	REAL	4	Volts	The scaled value of analog input 2. This value equals the voltage read at the analog input multiplied by the gain value, summed with the offset.
181	Get	ADC 2 Output	REAL	4	Volts	The unscaled value of analog input 2. This value equals the voltage read at the analog input.
182	Set	DAC 1 Mode	USINT	1		Selects on the following: 0 = Manual (default) - The voltage at the output is determined by the Manual DAC 1 Value setting of the output, along with its scale and offset. 1 = Auto - The voltage at the outputis determined by the DAC 1 Source setting along with its scale and offset.

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
183	Set	DAC 1 Source	USINT	1		Selects the signal used for the DAC 1 output voltage when DAC 1 Mode is set to Auto mode. 0 = Unassigned (default) 1 = Preg Command Pos 2 = Preg Command Vel 3 = Preg Feedbck Pos 4 = Preg Error 5 = Preg Output 6 = Preg Tune Cmd 7 = Preg Tune Fdbck 8 = Vreg Command Vel 9 = Vreg Command Acc 10 = Vreg Fdbk Vel 11 = Vreg Error 12 = Vreg Output 13 = Vreg Tune Cmd 14 = Vreg Tune Fdbk 15 = Shaft Position 16 = Shaft Angle 17 = Sine (Ireg) 18 = Cosine (Ireg) 19 = Ireg Loop Gain 20 = Average Current 21 = U Phase Current 22 = W Phase Current 23 = U Phase Voltage 24 = V Phase Voltage 25 = W Phase Voltage 26 = Torque Command 27 = Torque Feedback 28 = Torque Error 29 = Torque Output 30 = Field Feedback 31 = Field Error 32 = Field Output
184	Set	DAC 1 Scale	REAL	4		A multiplier applied to signal selected by the DAC 1 Source to obtain a scaled voltage value that is added to the DAC 1 Offset to obtain the DAC 1 output voltage. Range: -3.4e10 to 3.4e10 Default: 1
185	Set	DAC 1 Offset	REAL	4	Volts	A value added to the scaled voltage value. Range: -3.4e10 to 3.4e10 Default: 0
186	Set	Manual DAC 1 Value	REAL	4	Volts	The voltage value input to the Analog Output 1 when in Manual mode before the Scaled and Offset values are applied. Not saved in non-volatile memory. Range: -3.4e10 to 3.4e10 Default: 0

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
187	Get	DAC 1 Output	REAL	4	Volts	The Analog Output 1 output voltage value after the DAC 1 Scale and DAC 1 Offset values are applied.
188	Set	DAC 2 Mode	USINT	1		Selects on the following: 0 = Manual (default) - The voltage at the output is determined by the Manual DAC 2 Value setting of the output, along with its scale and offset. 1 = Auto - The voltage at the outputis determined by the DAC 2 Source along with its scale and offset.
189	Set	DAC 2 Source	USINT	1		Selects the signal used for the DAC 2 output voltage when DAC 2 Mode is set to Auto mode. 0 = Unassigned (default) 1 = Preg Command Pos 2 = Preg Command Vel 3 = Preg Feedbck Pos 4 = Preg Error 5 = Preg Output 6 = Preg Tune Cmd 7 = Preg Tune Fdbck 8 = Vreg Command Vel 9 = Vreg Command Acc 10 = Vreg Fdbk Vel 11 = Vreg Error 12 = Vreg Output 13 = Vreg Tune Cmd 14 = Vreg Tune Fdbk 15 = Shaft Position 16 = Shaft Angle 17 = Sine (Ireg) 18 = Cosine (Ireg) 19 = Ireg Loop Gain 20 = Average Current 21 = U Phase Current 22 = W Phase Current 23 = U Phase Voltage 24 = V Phase Voltage 25 = W Phase Voltage 26 = Torque Command 27 = Torque Feedback 28 = Torque Error 29 = Torque Output 30 = Field Feedback 31 = Field Error 32 = Field Output
190	Set	DAC 2 Scale	REAL	4		A multiplier applied to signal selected by the DAC 2 Source to obtain a scaled voltage value that is added to the DAC 2 Offset to obtain the DAC 2 output voltage. Range: -3.4e10 to 3.4e10 Default: 1

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
191	Set	DAC 2 Offset	REAL	4	Volts	A value added to the scaled voltage value. Range: -3.4e10 to 3.4e10 Default: 0
192	Set	Manual DAC 2 Value	REAL	4	Volts	The voltage value input to the Analog Output 2 when in Manual mode before the Scaled and Offset values are applied. Not saved in non-volatile memory. Range: -3.4e10 to 3.4e10 Default: 0
193	Get	DAC 2 Output	REAL	4	Volts	The Analog Output 2 output voltage value after the DAC 2 Scale and DAC 2 Offset values are applied.
194	Set	Clear Faults	USINT	1		Clears all drive faults. 0 = No Action (default) 1 = Execute Command
195	Set	User Current Fault Limit	REAL	4	Amps	The current level that will generate a fault when exceeded by the average current level. The drive always protects itself and the motor from average currents that exceed their ratings. This value is only needed if a lower average current fault is desired (For example, if another part of a machine would overheat). Range: 0 to 3.4e10 Default: 0
196	Set	User Current Fault	USINT	1		Determines if the User Current fault detection is enabled (turned on) or disabled. 0 = Disable (default) 1 = Enable
197	Set	User Velocity Fault Limit	REAL	4	cnts/ sec	The minimum velocity which causes the User Velocity fault. The drive always protects the motor from exceeding its ratings. This value is only needed if a lower velocity fault is desired. (For example, if another part of a machine could be damaged.) Range: 0 to 3.4e10 Default: 0
198	Set	User Velocity Fault	USINT	4		Determines if the User Velocity fault detection is enabled (turned on) or disabled. 0 = Disable (default) 1 = Enable
199	Set	Velocity Error Limit	REAL	4	cnts/ sec	The minimum velocity error that triggers the Velocity Error fault. Range: 0 to 3.4e10 Default: 80000
200	Set	Velocity Error Delay	REAL	4	msec	The minimum time which the velocity error must be greater than the Velocity Error Limit to cause a Velocity Error fault. Range: 0 to 3.4e10 Default: 1000

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
201	Set	Position (Following) Error Limit	DINT	4	cnts	The minimum position error that triggers the Position (Following) Error fault Range: 0 to 2147483647 Default: 8000
202	Set	Position (Following) Error Delay	REAL	4	msec	The minimum time during which the position error must be greater than the Position (Following) Error Limit to cause a Position (Following) Error fault. Range: 0 to 3.4e10 Default: 100
203	Get	Fault Status	DWORD	4		The Controller Fault Status provides the present state of the possible fault conditions. Bit 3 = Motor Overtemperature Bit 4 = IPM Fault Bit 8 = Bus Undervoltage Bit 9 = Bus Overvoltage Bit 10 = Bad (Illegal) Hall State Bit 13 = Network Communication Bit 16 = User Current Bit 17 = Overspeed Bit 18 = Position (Following) Error Bit 19 = Motor Encoder Error Bit 20 = Auxiliary Encoder Error Bit 21 = Motor Filter Bit 22 = IPM Filter Bit 23 = Velocity Error Bit 25 = User Velocity
204	Get	Fault Count	DINT	4		Displays the number of faults recorded since power-up of the drive.
205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224	Get	Fault History 1 through Fault History 20	USINT	1		Returns the most recent faults detected in the drive. Fault History 1 is the most recent, Fault History 20 is the oldest. 0 = No Fault 4 = Motor Overtemperature 5 = IPM Fault 9 = Bus Undervoltage 10 = Bus Overvoltage 11 = Bad (Illegal) Hall State 14 = Network Communication 17 = User Current 18 = Overspeed 19 = Position (Following) Error 20 = Motor Encoder Error 21 = Auxiliary Encoder Error 22 = Motor Filter 23 = IPM Filter 24 = Velocity Error 26 = User Velocity 58 = Excess CPU Load

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
225	Get	Controller Drive Type	USINT	1		The type of Ultra5000 drive. 0 = Invalid 1 = 2098-IPD-005-DN 2 = 2098-IPD-010-DN 3 = 2098-IPD-020-DN 4 = 2098-IPD-030-DN 5 = 2098-IPD-075-DN 6 = 2098-IPD-150-DN 7 = 2098-IPD-HV030-DN 8 = 2098-IPD-HV050-DN 9 = 2098-IPD-HV100-DN 10 = 2098-IPD-HV150-DN 11 = 2098-IPD-HV220-DN
226	Get	PICS Number	SHORT_STRING	1 byte length indicator, 1 byte per character		A unique identifier assigned to each drive.
227	Get	Controller Firmware Version	SHORT_STRING	1 byte length indicator, 1 byte per character		The version of the drive's main firmware in the format XX.YY.ZZ, where: XX = major revision YY = minor revision ZZ = maintenance revision
228	Get	Controller Boot Version	SHORT_STRING	1 byte length indicator, 1 byte per character		The version of the drive's boot firmware in the format XX.YY.ZZ, where: XX = major revision YY = minor revision ZZ = maintenance revision
229	Get	Controller FPGA Version	SHORT_STRING	1 byte length indicator, 1 byte per character		The version of the firmware containing the FPGA image and the burn in self test code. The format is XX.YY.ZZ, where: XX = major revision YY = minor revision ZZ = maintenance revision
230	Get	Controller Rated Current	REAL	4	Amps	The maximum current the drive can continuously produce without faulting.
231	Get	Controller Peak Current	REAL	4	Amps	The maximum current the drive can produce on an intermittent basis.
232	Get	Service Clock	DINT	4	secs	The seconds the drive has been powered up.
233	Get	Controller Info Version	DINT	4		The info version is the revision of the structure that was used to store the manufacturing data. If this value is greater then zero, the manufacturing data is valid. Otherwise, the data is invalid and has not been loaded.
234	Get	Date Code	DINT	4		The date code indicates when the control was manufactured. If the info version is zero, this value will also be zero

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
235	Get	Controller Create Version	DINT	4		The create version indicates the version of firmware that was installed when the control was manufactured. If the info version is zero, this value will also be zero.
236	Get	Controller Assembly Revision	SHORT_STRING	1 byte length indicator, 1 byte per character		The assembly rev is a string indicating the revision of the hardware that was installed when the control was manufactured. If the info rev is zero, this value will be a blank string.
237	Set	Auto Motor Identification	USINT	1		Specifies if the drive should read the motor parameters from an intelligent encoder or from non-volatile RAM. 0 = Disable - read motor parameters from non-volatile RAM. 1 = Enable (default) - read motor parameters from an intelligent encoder.
238	Get	Motor Model	SHORT_STRING	1 byte length indicator, 1 byte per character		The model name for the motor being used by the drive.
239	Get	Reserved	USINT	1		Default: 0
240	Set	Total Linear Mass	REAL	4	kg	(Only for linear motors.) The moving mass of linear motor and load combined.
241	Get	Motor Flag	USINT	1		Indicates if the drive is configured for a standard or custom motor. 0 = Invalid (default) 1 = Standard Motor - indicates a motor that is pre-configured in Ultraware. 2 = Custom - indicates a user-configured motor which was added to Ultraware Motor database using a utility that ships with Ultraware.
242	Get	Motor Type	USINT	1		The type of motor selected. 0 = Rotary (default) 1 = Linear
243	Get	Motor Rotary Torque Constant	REAL	4	N-m/A	The sinusoidal torque constant for a rotary motor.
244	Get	Motor Rotary Inertia	REAL	4	$kg\text{-}cm^2$	Rotor inertia for a rotary motor.
245	Get	Motor Rotary Pole Count	DINT	4		The number of motor poles per revolution (only for a rotary motor).
246	Get	Motor Linear Force Constant	REAL	4	N/A	The sinusoidal force constant for a linear motor.
247	Get	Motor Linear Mass	REAL	4	kg	The mass of the moving part (rotor) of a linear motor.

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
248	Get	Motor Linear Cycle Length	REAL	4	meter	The distance between motor poles for a linear motor.
249	Get	Integral Limits	USINT	1		Indicates whether the motor provides built in feedback for travel limits. 0 = No (default) 1 = Yes
250	Get	Motor Rated Voltage	REAL	4	Volts	Voltage rating of the motor.
251	Get	Motor Resistance	REAL	4	Ohms	The phase-to-phase resistance of the motor stator.
252	Get	Motor Inductance	REAL	4	mH	The phase-to-phase inductance of the motor stator.
253	Get	Flux Saturation 0	REAL	4		The motor flux saturation value at 12.5% of motor peak current. A value of one (1) indicates no saturation.
254	Get	Flux Saturation 1	REAL	4		The motor flux saturation value at 25% of motor peak current. A value of one (1) indicates no saturation.
255	Get	Flux Saturation 2	REAL	4		The motor flux saturation value at 37.5% of motor peak current. A value of one (1) indicates no saturation.
256	Get	Flux Saturation 3	REAL	4		The motor flux saturation value at 50% of motor peak current. A value of one (1) indicates no saturation.
257	Get	Flux Saturation 4	REAL	4		The motor flux saturation value at 62.5% of motor peak current. A value of one (1) indicates no saturation.
258	Get	Flux Saturation 5	REAL	4		The motor flux saturation value at 75% of motor peak current. A value of one (1) indicates no saturation.
259	Get	Flux Saturation 6	REAL	4		The motor flux saturation value at 87.5% of motor peak current. A value of one (1) indicates no saturation.
260	Get	Flux Saturation 7	REAL	4		The motor flux saturation value at 100% of motor peak current. A value of one (1) indicates no saturation.
261	Get	Motor Rotary Maximum Speed	REAL	4	RPM	Maximum speed of a rotary motor.
262	Get	Motor Linear Maximum Speed	REAL	4	m/sec	Maximum speed of a linear motor.
263	Get	Motor Peak Current	REAL	4	Amps	Maximum intermittent current of the motor.
264	Get	Motor Rated Current	REAL	4	Amps	Continuous current rating of the motor.

Parameter Object, Instances ID 1- 340

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
265	Get	Motor Encoder Type	USINT	1		Type of motor encoder. 0 = None 1 = Incremental 2 = Sine/Cosine 3 = Intelligent
266	Get	Motor Commutation Type	USINT	1		The type of motor commutation. 0 = Brush 1 = Trapezoidal 2 = Sinusoidal
267	Get	Motor Startup Type	USINT	1		The type of motor startup for sinusoidal commutation. 0 = Self-Sensing 1 = Hall Inputs
268	Get	Motor Hall Offset	REAL	4	degs	Hall Input offset in units of electrical degrees.
269	Get	Motor Rotary Line Count	DINT	4	lines/ rev	The number of encoder lines per revolution on a rotary motor encoder.
270	Get	Motor Linear Line Count	DINT	4	lines/m	The number of encoder lines per meter of travel on a linear motor encoder.
271	Get	Motor Thermostat	USINT	1		Indicates whether the motor has a built-in thermostat. 0 = Not Present 1 = Present
272	Get	Motor Soft Protection	USINT	1		Determines whether the motor thermal protection software is activated. 0 = Disabled 1 = Enabled
273	Get	Motor Rth(w-e)	REAL	4	C/W	Thermal resistance from the winding to the encoder.
274	Get	Motor Cth(w-e)	REAL	4	W-s/C	Thermal capacitance from the winding to the encoder.
275	Get	Motor Rth(w-a)	REAL	4	C/W	Thermal resistance from the winding to ambient.
276	Get	Motor Cth(w-a)	REAL	4	W-s/C	Thermal capacitance from the winding to ambient.
277 - 308	Set	Integer Data 0 - 31	DINT	4		Range: -2147483648 to 2147483647 Default: 0 Automatically saved in non-volatile storage.
309 - 340	Set	Float Data 0 - 31	REAL	4		Range: -3.4e10 to 3.4e10 Default: 0 Automatically saved in non-volatile storage.

Parameter Object Instance Attributes

Attr ID	Access Rule	Stub/ Full	Name	Data Type	Description
1	1	Stub	Parameter Value	Data type specified in Descriptor, Data Type and Data Size	Actual value of parameter. It can be read from or written to. This attribute is read-only if bit 4 of Attribute 4 is TRUE.
2	Get		Link Path Size	USINT	Size of Link Path attribute. If this attribute is 0, then no link is specified. Number of BYTEs in attribute 3.
3			Link Path	ARRAY of DeviceNet path	Path to the object from where this parameter value is retrieved. The link path is limited to 255 BYTEs.
			Segment Type/Port	BYTE	Refer to the DeviceNet Specification listed in *Related Documentation* on page P-3 for a description of the data type: Segment Type/Port.
			Segment Address	EPATH	Path (format depends on data contained in segment type/port)
4			Descriptor	WORD	Descriptor of parameter. *Bit Definitions for Instance Attribute 4* on page 4-51
5			Data Type	USINT	Data type code. *Data Types for Instance Attribute 5* on page 4-51
6			Data Size	USINT	Number of BYTEs in Attribute 1, Parameter Value

Parameter Object
Instance Attributes (Continued)

Attr ID	Access Rule	Stub/ Full	Name	Data Type	Description
7	Get	Full	Parameter Name	SHORT_ STRING [2]	A human readable string representing the parameter name. For example, "Vel Loop P-Gain" The maximum number of characters is 16. (The first byte is a length code.)
8			Units String		Engineering unit string. The maximum number of characters is 4. (The first byte is a length code.)
9			Help String		The maximum number of characters is 64. (The first byte is a length code.)
10			Minimum Value	Data type specified in Descriptor, Data type and Data Size [1]	The minimum valid actual value to which attribute 1, Parameter Value can be set.
11			Maximum Value		The maximum valid actual value to which attribute 1, Parameter Value can be set
12			Default Value		The actual value attribute 1, Parameter Value should be set to when you want the default for the parameter.
13			Scaling Multiplier	UINT [2]	Multiplier for scaling formula
14			Scaling Divisor		Divisor for scaling formula
15			Scaling Base		Base for scaling formula
16			Scaling Offset		Offset for scaling formula
17			Multiplier Link		Parameter object instance number of multiplier source.
18			Divisor Link		Parameter object instance number of divisor source.
19			Base Link		Parameter object instance number of base source.
20			Offset Link		Parameter object instance number of offset source.
21			Decimal Precision	USINT [2]	Specifies number of decimal places to use when displaying the scaled engineering value. Also used to determine actual increment value so that incrementing a value causes a change in scaled engineering value to this precision.

[1] The access rule is defined in *Bit Definitions for Instance Attribute 4* on page 4-31:
If bit 4 is 0 the access rule is Set and the Parameter Value can be read and written.
If bit 4 is 1, the access rule is Get and the Parameter Value can only be read.

[2] Data type specified in *Data Type Definitions* on page 4-4.

Parameter Object
Bit Definitions for Instance Attribute 4

Bit	Definition	Value
0	Supports settable path	0 = Link path can not be set. 1 = Link path can be set.
1	Supports enumerated strings	0 = Enumerated strings are not supported. 1 = Enumerated strings are supported and may be read with the Get_Enum_String service.
2	Supports scaling	0 = Scaling not supported. 1 = Scaling is supported. The scaling attributes are implemented and the value presented is in engineering units.
3	Supports scaling links	0 = Scaling links not supported. 1 = The values for the scaling attributes may be retrieved from other parameter object instances.
4	Read only parameter	0 = Parameter value attribute can be written (set) and read (get). Access rule is set. 1 = Parameter value attribute can only be read. Access rule is get.
5	Monitor parameter	0 = Parameter value attribute is not updated in real time by the device. 1 = Parameter value attribute is updated in real time by the device.
6	Supports extended precision scaling	0 = Extended precision scaling is not supported. 1 = Extended precision scaling should be implemented and the value is presented in engineering units.

Parameter Object
Data Types for Instance Attribute 5

Data Type Name	Data Type Code (in Hex)	Data Type Description
SINT	C2	Signed 8-bit integer value
INT	C3	Signed 16-bit integer value
DINT	C4	Signed 32-bit integer value
USINT	C6	Unsigned 8-bit integer value
UINT	C7	Unsigned 16-bit integer value
UDINT	C8	Unsigned 32-bit integer value
REAL	CA	32-bit floating point value
BYTE	D1	bit string, 8-bit
WORD	D2	bit string, 16-bit
DWORD	D3	bit string, 32-bit
SHORT_STRING	DA	Character string (1 byte per character, 1 byte length indicator)

Parameter Object Common Services			
Service Code	**Implemented for:**		**Service Name**
	Class	**Instance**	
0x01	No	Yes	Get_Attribute_All
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single
0x16	Yes	No	Save

Get_Attribute_All Response

At the instance level, the order of attributes returned in the Get_Attribute_All Response is as follows:

Class Attribute ID	Attribute Name and Default Value
1	Parameter Value
2	Link Path Size
3	Link Path
4	Descriptor
5	Data Type
6	Data Size
7	Parameter Name String, default character count = 0
8	Units String, default character count = 0
9	Help String, default character count = 0
10	Minimum Value default = 0
11	Maximum Value default = 0
12	Default Value default = 0
13	Scaling Multiplier Default = 1
14	Scaling Divisor Default = 1
15	Scaling Base Default = 1
16	Scaling Offset Default = 0
17	Multiplier Link Default = 0
18	Divisor Link Default = 0
19	Base Link Default = 0
20	Offset Link Default = 0
21	Decimal Precision Default = 0

Parameter Object Specific Services		
Service Code	**Service Name**	**Service Description**
$4B_H$	Get_Enum_String	Use this service to read enumerated strings from the Parameter Instance. See DeviceNet Specification Vol 2: Object Library, Parameter Object referenced on page P-3.

Enumerated strings are human-readable strings that describe either a bit or a value depending on the data type of instance attribute 1, the Parameter Value. If the data type is a BYTE, WORD, or DWORD the enumerated string is a bit enumerated string. If the data type is INT, USINT, or UINT the enumerated string is a value enumerated string. Any other data type does not have enumerated strings.

The table below describes the Get_Enum_String request service attribute.

Name	Data Type	Description of Attribute
Enumerated String Number	USINT	Number of enumerated string to retrieve (MAX value is 255).

- If the string to be returned is a bit enumerated string, then the enumerated string number represents a bit position and the Get_Enum_String service returns a string describing that bit.
- If the string to be returned is a value enumerated string, then the enumerated string number represents a value and the Get_Enum_String service returns a string for that value.

The enumerated string is returned in the form of a SHORT_STRING with a maximum number of characters of 16.

Troubleshooting DeviceNet Drives

Chapter Objectives

This chapter provides a description of maintenance and troubleshooting activities for the DeviceNet interface to the Ultra5000. This chapter includes the following sections.

- Module Status LED
- Network Status LED
- Node Problems
- Device Failure - LED Status Check
- Scanner Problems
- Power Supply Problems
- Cable Installation and Design Problems
- Adjusting the Physical Network Configuration

For maintenance and troubleshooting information specific to the Ultra5000 drive, refer to the *Ultra5000 Intelligent Positioning Drive Installation Manual* (2098-IN001*x*-EN-P).

Module Status LED

Use the table below for troubleshooting the Module Status LED on the DeviceNet interface to the Ultra5000.

If the Module Status LED is:	Status is:	Potential Cause is:	Possible Resolution is:
Off	Not powered	No power	Provide power to the device.
Flashing-red	Recoverable fault	Not operational	Power cycle or reset the drive.
Steady-red	Unrecoverable fault	Drive problem	Check drive for power-up error. Replace drive.
Flashing-red/ green	Self testing	Self-test or initialization in progress	The DeviceNet interface is being initialized or in self-test — wait.
Flashing-green	Device is in stand-by	Processing or waiting for input	Normal operation - no action needed.
Steady-green	Operational	Normal operation	Normal operation - no action needed.

Network Status LED

Use the table below for troubleshooting the Network Status LED on the DeviceNet interface to the Ultra5000.

If the Network Status LED is:	Status is:	Potential Cause is:	Possible Resolution is:
Off	Not powered Not on-line	No power going to the device. Failed Duplicate MAC ID check. No network (24V) power Network miswired.	1. Check the Module Status LED to verify that the drive is powered. 2. Check that one or more nodes are communicating on the network. 3. Check that at least one other node on the network is operational and the data rate is the same as the drive. 4. Provide network (24V) power. 5. Check that the DeviceNet connector is correctly wired.
Flashing-red	On-line Time-out	I/O connection timed out.	1. Re-initiate I/O messaging by the master controller. 2. Reduce traffic or errors on the network so that messages can get through within the necessary time frame.
Steady-red	Network failure	Failed Duplicate MAC ID check. Bus off.	1. Ensure that all nodes have unique addresses. 2. If all node addresses are unique, examine network for correct media installation. 3. Ensure that all nodes have the same Data Rate.
Flashing-green	On-line Not connected	Passed Duplicate MAC ID check. No connection established.	No action is needed. The LED is flashing to signify that there are no open communication connections between the drive and any other device. Any connection (I/O or explicit message) made to the drive over DeviceNet will cause the LED to stop flashing and remain Steady-ON for the duration of any open connection.
Steady-green	On-line Connected	One or more connections established.	No action needed. This condition is normal.

Node Problems

Give particular attention to the task of setting initial addresses and data rates. Survey the network to ensure all assignments are known. Some nodes can be logically assigned to a group of devices, but physically located away from those devices. One incorrect node can cause other nodes to appear to be bus-off (steady-red Network Status LED). If a node goes bus-off and the device is reset but bus-off faults again, the problem is likely not with the device. The problem is likely to be the setting of the address, data rate, or a network-wide problem related to topology, grounding, intermittent power/data connections, or electrical noise. In the event that a scanner goes bus-off, nodes will not reallocate (flashing-green or red) even if they are functioning correctly.

Device Failure - LED Status Check

A steady-red Module Status LED can mean an error. If the Network Status LED goes steady-red at power-up, it could mean there is a Duplicate MAC ID. The user response is to test all devices for unique addresses. If a steady-red LED remains on after the Duplicate MAC ID test shows all devices to have a unique node address, it means a Bus-off error. Do the following:

- Check data rate settings.
- If symptom persists, replace node address (with another address and correct data rate).
- If symptom persists, replace tee tap.
- If symptom persists, check topology.
- If symptom persists, check power for noise with oscilloscope or power disturbance analyzer.

Scanner Problems

If using a scanner, check the scan list, data rate, and addresses of devices. Verify series and revision of the scanner is the latest. If the scanner is Bus-off, recycle the 24V supply and then reset the scanner. If the scanner goes Bus-off again, the problem is some combination of:

- Defective node device
- Incorrect node data rate
- Bad network topology
- Faulty wiring
- Faulty scanner
- Faulty power supply
- Bad grounding
- Electrical noise

Power Supply Problems

If a single power supply is used, add up the current requirements of all devices drawing power from the network. This total should be considered the minimum current rating in selecting the power supply used. In addition check the:

- Length and current level in trunk and drop cables
- Size and length of the cable supplying power to the trunk
- Voltage measured at the middle and ends of the network
- Noise in network power measured with an oscilloscope

Cable Installation and Design Problems

Cable installation and design refers to the physical layout and connections on the network. Walk the network if possible to determine the actual layout and connections. Network management software displays only a logical record of the network. Ensure that you have a diagram of the physical layout and a record of the information from the tables below.

Cable Checks
Number of nodes
Individual drop lengths
Branched drop length
Cumulative drop length
Total trunk length
Power supply cable length and gauge
Terminator locations and size

Power Checks
Break the earth ground of the V- and Shield and verify >1.0 Mohm to frame ground with power supply off
Use a multi-meter to check for short circuit between CAN_H and CAN_L, or CAN (H or L) to Shield, V- or V+
Total power load and at its distribution points
Spot check power for noise

Adjusting the Physical Network Configuration

Ways to improve the efficiency of your physical network configuration include:

- Shortening the overall length of the cable system
- Moving the power supply in the direction of an overloaded cable section
- Moving devices from an overloaded cable section to a less loaded section
- Moving higher current loads closer to the power supply
- Adding another power supply to an overloaded network
- Moving the power supply from the end to the middle of the network

A

B

C

D

E

F

H

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L

M

N

O

P

R

S

T

U

W

Z

Notes

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support, you can find technical manuals, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools. You can also visit our Knowledgebase at http://www.rockwellautomation.com/knowledgebase for FAQs, technical information, support chat and forums, software updates, and to sign up for product notification updates.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect^{SM} support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/support/.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview.page, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to help ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication RA-DU002, available at http://www.rockwellautomation.com/literature/.

www.rockwellautomation.com

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